R. R. Kelly 59 Mark Lane E.C. London

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXIII. No. 839.] LONDON, JUNE 10, 1879. [31st Year.] Price 6d.

GAS PURIFICATION
BY
OXIDE OF IRON.

COOKE BROS.,
CENTRAL DEPÔTS:
CO. DONEGAL, IRELAND;
LONDON DEPÔT:
BLACKWALL, E.;
OFFICES:
26, 27, & 28, FENCHURCH ST.,
LONDON, E.C.

GENUINE TORBAY PAINT
And SPECIAL GASOMETER PAINT.
Several Prize Medals. Established over 20 Years.
These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.
Supplied, mixed ready for use, or in paste, as desired.
TORBAY PAINT COMPANY.
Proprietors: STEVENS & CO.,
21, GREAT WINCHESTER STREET, LONDON.
Works: BRIXHAM, TORBAY.

THOMAS PROUD,
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.
CONTRACTOR FOR
LAYING MAINS
FOR
Gas, Water, & Sanitary Purposes,
AND MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL & CO.,
LIMITED,
Established at the commencement of Gas Lighting,
Manufacturers of
TUBES AND FITTINGS.
THREE PRIZE MEDALS,
Paris, 1878.
Head London Office:
145, QUEEN VICTORIA STREET.
ALMA TUBE-WORKS, WALSALL;
OLD PATENT TUBE-WORKS, WEDNESBURY.

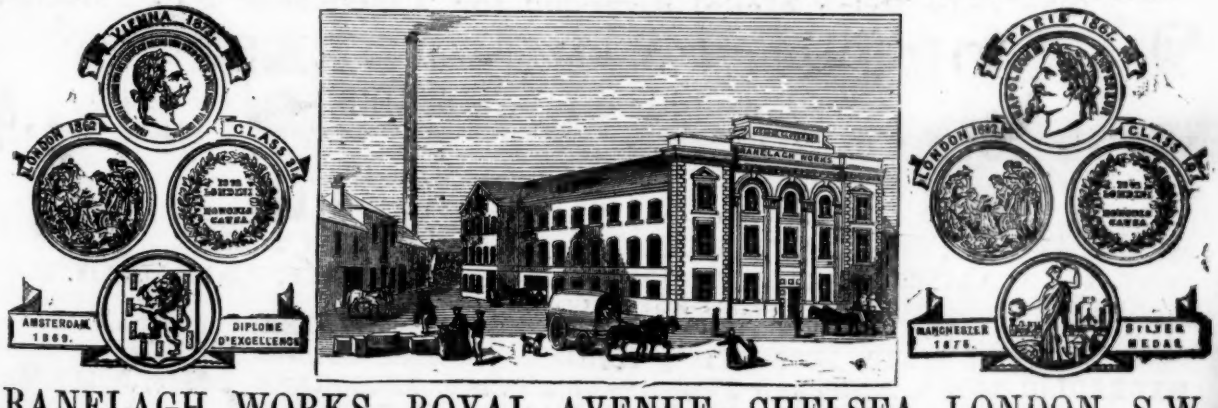
JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
LICENSEES AND MANUFACTURERS OF
HUNT'S
PATENT COMPENSATING METERS,
STREET-LAMPS, &c., &c.
Established 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
London Offices: 97, CANNON STREET—
JAMES E. & SAMUEL SPENCER, Agents.

THE
"OTTO" GAS-ENGINE.
See Page 874.
CROSSLEY BROTHERS,
MANCHESTER AND LONDON.

THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.
AGENT:
JAMES M'KELVIE,
HAYMARKET,
EDINBURGH.

CHANGE OF ADDRESS.
GEORGE GLOVER AND CO.,
DRY GAS-METER MANUFACTURERS,
HAVE REMOVED TO MORE EXTENSIVE PREMISES:



RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

AND

COOMBS WOOD TUBE-WORKS, HALESOWEN,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS,

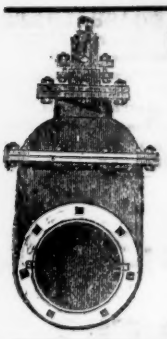
AND

LAP-WELDED IRON AND HOMOGENEOUS METAL BOILER TUBES,

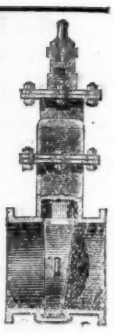
UP TO FOUR FEET IN DIAMETER.

London Offices: No. 4, Cloak Lane, Queen Street, E.C.

Warehouses: London, Liverpool, Manchester, and Lille.



C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;

CONTRACTORS FOR THE

ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

TRADE MARK

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM.

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

LONDON OFFICES: 97, CANNON STREET—JAMES E. & SAMUEL SPENCER, AGENTS.

GAS COAL. GAS COAL. GAS COAL.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise **2000 tons per day of REAL OLD SILKSTONE GAS COAL.**

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

HONOURABLE MENTION, **J. E. WILLIAMS & CO.,** PARIS EXHIBITION, 1878.

SOLE MANUFACTURERS OF THE

SPECIAL METALLIC OXIDE PAINT,

Largely used by Gas Companies, Corporations, Railway Companies, Ironfounders, and Machinists. It has the following qualifications and properties:—

EFFECTUALLY PREVENTS AND ARRESTS CORROSION.
HAS A FINE GLOSS, AND IS VERY DURABLE.
DOES NOT REQUIRE DRIERS LIKE OTHER PAINTS.
PROTECTS IRON FROM ACTION OF WATER.

IS NOT AFFECTED BY SULPHURETTED HYDROGEN.
FORMS A VERY HARD TOUGH (NOT BRITTLE) SURFACE.
WILL NOT CRACK, BLISTER, OR SCALE.
IS NOT AFFECTED BY EXTREMES OF TEMPERATURE.

COVERS NEARLY DOUBLE THE AREA OF OTHER PAINTS.
(7 gallons or 1 cwt. will cover 1211 square yards of Ironwork.)
IS CHEAPER AND MORE ECONOMICAL THAN ANY OTHER.

VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.

HYDRATED PURIFYING MATERIAL.

Samples on application.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.

PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER AND BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM (Established 1765),

MANUFACTURER OF

TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST-IRON TANKS FOR DITTO.

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, AND ALL KINDS OF GAS APPARATUS.

WROUGHT-IRON ROOFS, BRIDGES, GIRDERS, ETC.

STEAM, HOT WATER, AND RANGE BOILERS, TANKS, CISTERNS, BOATS,

AND ALL KINDS OF WROUGHT-IRON WORK.

Drawings, Specifications, and Estimates supplied on application.

GAS PURIFICATION

BY

OXIDE OF IRON.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

SAMUEL CUTLER & SONS,

CONTRACTORS FOR GAS & WATER WORKS, GENERAL ENGINEERS, IRONFOUNDERS & MANUFACTURERS OF

GASHOLDERS, TANKS, PURIFIERS,

SCRUBBERS, VALVES, EXHAUSTERS, IRON ROOFS, BRIDGES, BOILERS, AND GENERAL CAST AND WROUGHT IRON WORKS.

S. C. & SONS undertake the entire erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the supplying and laying of MAINS.

They make a speciality of supplying every requisite whatever for Gas-Works, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

Manufacturers of MORRIS & CUTLER'S PATENT CONDENSER & CUTLER'S PATENT GAS-WASHER.

DESCRIPTION OF MORRIS & CUTLER'S PATENT CONDENSER.—The Condenser may consist of pipes arranged in tiers, or in any other form most convenient to the site available, each tier being connected with special connections, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. The Condenser itself may form the support for a high-level cistern. By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control. The Condenser may be seen in operation at the Brentford Gas-Works.

For further Particulars, apply to Mr. F. MORRIS, GAS-WORKS, BRENTFORD, or to S. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.

1862.

CLASS 11.

HALLETT'S
PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

Price 30s. per Cwt. Special Driers supplied at same Price.

This light stone-coloured Paint, for which a Prize Medal was obtained in 1862, is free from certain defects of white lead. It does not produce any deleterious effect upon the health of those who use it, such as painter's colic, nor is it blackened by sulphur compounds in the atmosphere; while, from its less specific gravity and good body, it covers more surface, weight for weight, and, therefore, it is preferable and more economical than white lead.

It is peculiarly adapted for Gas-Works.

GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.

MANUFACTURED BY GUEST AND CHRIMES,

FOUNDRY AND GENERAL BRASS WORKS, ROTHERHAM; AND 85, SOUTHWARK ST., LONDON, S.E.

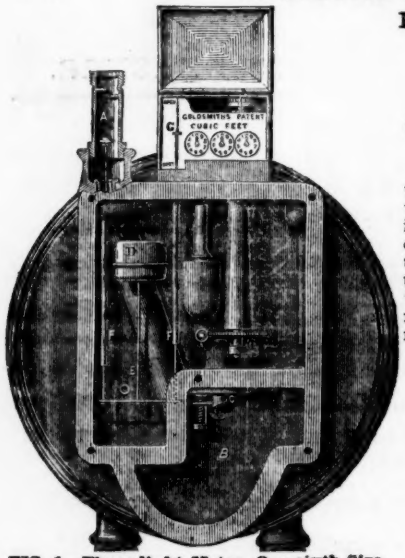


FIG. 1.—Three-light Meter, One-sixth Size

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

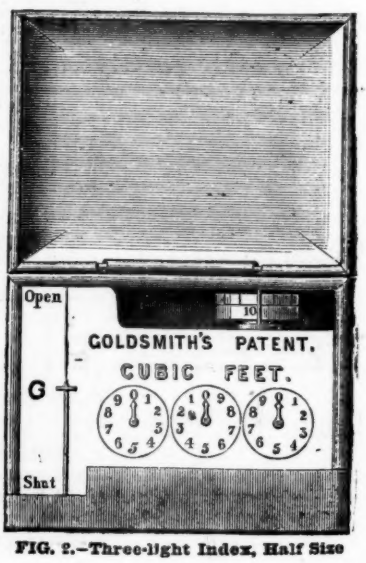


FIG. 2.—Three-light Index, Half Size

GEORGE ORME & CO.,

ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

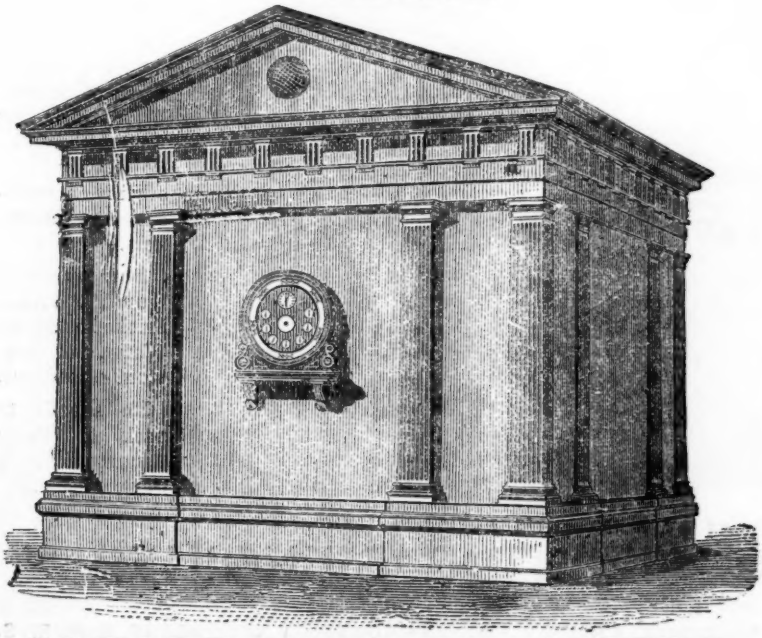
OF THE HIGHEST EXCELLENCE ONLY;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of **CONSUMERS METERS, STATION-METERS, and GOVERNORS** generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c. ON APPLICATION.

C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,
DONNINGTON, NEAR NEWPORT, SHROPSHIRE.
FINSBURY CIRCUS, LONDON.

ESTABLISHED IN 1860.

BENJAMIN CARPENTER,

THE ORIGINAL MANUFACTURER OF THE IMPROVED

WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,
22, HERMES STREET, PENTONVILLE ROAD,
LONDON, N.

The Dunston Engine Works Co.

GATESHEAD-UPON-TYNE.

Are the Sole Manufacturers of

Archer's Patent Hoists,

ALSO OF

Archer's Patent Stone Breaker, &c., &c.,

(As supplied to Sir Wm. Geo. Armstrong, C.B.),

AND OF

Archer's Patent Ore Crusher & Pulveriser,

Unequalled for the purposes of Mine Owners, Chemical Manufacturers, Cement Manufacturers, and others.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

GRIRDROD'S PATENT

PORTABLE PIPE SCREWING

MACHINE,

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD,

LANCASHIRE.

Gold Medal Awarded, Paris Exhibition, 1878.

THOMAS TURTON AND SONS,

SHEAF AND SPRING WORKS,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS,

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNER RATCHET BRACES, LIFTING-JACKS, ANVILS, VICES, AND ENGINEERS TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

R. W. WINFIELD AND CO.,

CAMBRIDGE STREET WORKS AND ROLLING MILLS,

BIRMINGHAM.

The following Medals have been awarded:—

GRAND COUNCIL MEDAL, LONDON, 1851. MEDAL, LONDON, 1862. GOLD MEDAL, PARIS, 1867,

The only Gold Medal awarded for "Apparatus and Processes for Heating and Lighting" by the Imperial Commissioners

MEDAL FOR PROGRESS, VIENNA, 1873.

The following Medals were also awarded at Paris, 1878:—

GOLD MEDAL for Chandeliers and Gas-Fittings.

GOLD MEDAL (Rappel) for Metallic Bedsteads and Furniture.

GOLD MEDAL (Rappel) for Art Metal Work. BRONZE MEDAL for Tube Metal and Wire.

MANUFACTURERS OF BRASS AND COPPER SHEETS,

TUBE AND WIRE,

ROLLED METALS, LOCOMOTIVE AND CONDENSER TUBES, CYLINDERS;

Ornamental, Taper, and Cased Tubes; Tin Tubes;

GAS-FITTINGS, CHANDELIERS,

BRACKETS FOR HEATING AND LIGHTING;

METALLIC BEDSTEADS.

Ecclesiastical and Mediæval Metal Workers.

GENERAL BRASSFOUNDERS.

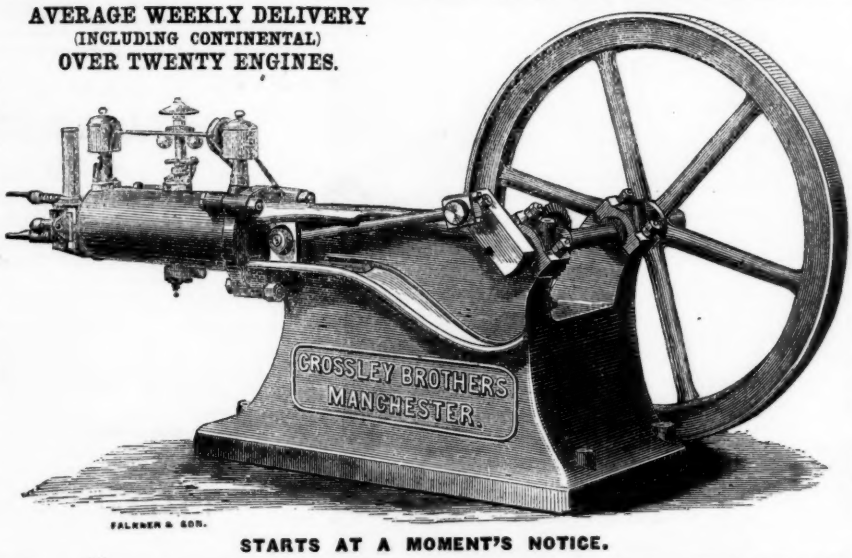
REGISTERED TRADE MARK:

LONDON OFFICES & SHOW-ROOMS: R. W. W. & CO. 141, FLEET STREET, E.C.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

AVERAGE WEEKLY DELIVERY
(INCLUDING CONTINENTAL)
OVER TWENTY ENGINES.

The durability of these Engines is now established by experience, one of them having run night and day at the Hinckley Gas-Works for over Twelve months without any expenditure for repair; this being equal to about 2½ years average work.



Over 1900 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

No trouble with Coal, Ashes, Smoke, Insurance, Water, or constant attendance.

No Glands to pack, or Water Gauges and Steam Gauges to watch.

STARTS AT A MOMENT'S NOTICE.

THE "OTTO" SILENT GAS-ENGINE.

(Otto and Crossley's Patents, 1876 and 1877,)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER.	SIZES									OFFERED.	CASES NOT CHARGED IF RETURNED FREE
	NOMINAL HORSE POWER	½	1	2	3½	6	8	12	16		
	MAXIMUM HORSE POWER	¾	1½	2½	4	9	12	18	24		

PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES).

WORKS AND HEAD OFFICES: Gt. Marlbro' St., Gloster St.

CROSSLEY BROTHERS, MANCHESTER.

LONDON HOUSE: 116, Queen Victoria St., E.C.

TANGYE BROTHERS AND HOLMAN,

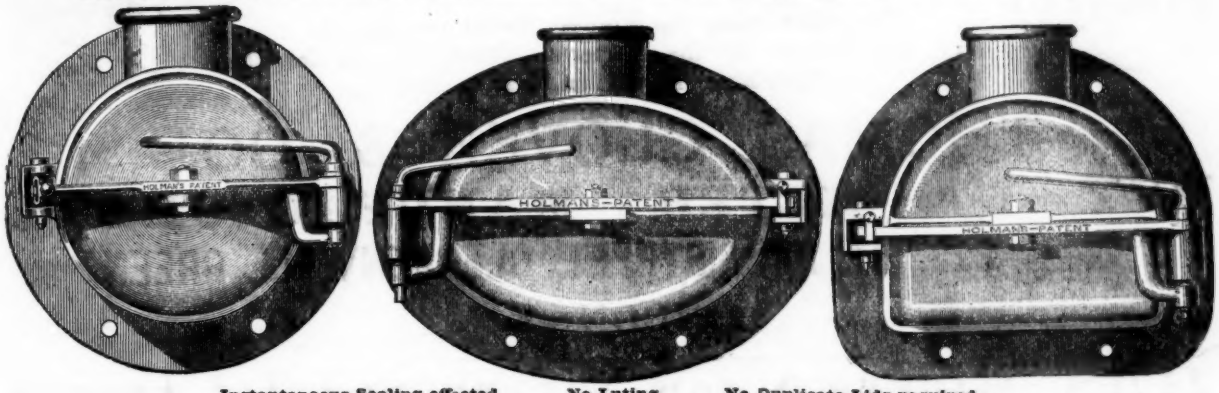
CORNWALL HOUSE, 35, QUEEN VICTORIA STREET, LONDON, E.C.,

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly itested, being now in use in nearly all the principal Gas-Works in London and the Provnces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland.

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

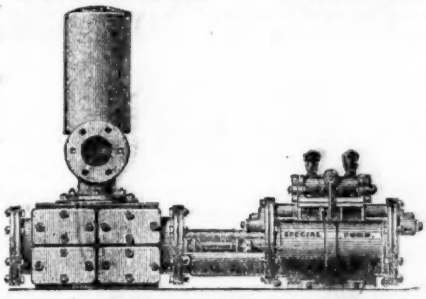
Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom fo Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters bv the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

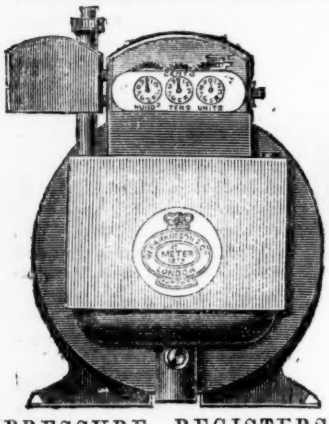
214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.,



(ESTABLISHED 1816,)

MANUFACTURERS OF

WET & DRY METERS,

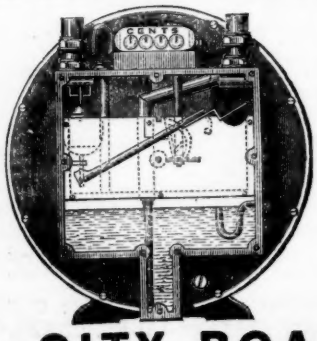
STATION-METERS & GOVERNORS,

EXHAUSTER REGULATORS,

PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

HUNT'S PATENT IMPROVED COMPENSATING METER.

In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."



The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

R. M.—*Too late for this week.*

We would again remind correspondents that, to ensure insertion in the next number of the JOURNAL, *letters should reach the Office by Saturday at latest.*

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 10, 1879.

Circular to Gas Companies.

THE big sale of Chartered Company's stock will come off on the 19th inst. What prices the new issue will fetch can only be imagined from those at which the present "A" stock stands in the market to-day. The premiums realized, we believe, will be, we will not say enormous, but it is probable that little will be bought to pay much over five per cent. This is small enough interest for investors who put their money in the concern for the first time; but the provisions of the Act under which the sale takes place are specially hard upon old Shareholders, who are fairly entitled to a *pro ratâ* issue at par. The sale will, no doubt, draw a very large number of investors, but the range of prices is certain to be small. The lots are arranged so as to suit all classes, from the man who can put his two thousand pounds per lot in, to the poorer investor who can only put in his hundred pounds. We expect, however, that the lots will all go off in large quantities, for it is one condition that the purchaser of any lot will have the opportunity of securing a considerable number of other lots at the price he gives for the first lot, without any further auctioneering. This sale will constitute an era in the history of gas enterprise. The electric "scare" has passed away, and gas property has resumed what may be called its normal value. It will be remarkable in another sense; it will be the first occasion on which gas stock on such a considerable scale has been put up to auction, to produce premiums which will not be entitled to dividend.

An extraordinary meeting of the Shareholders of the South Metropolitan Gas Company has confirmed the resolution of the Directors to unite with the Surrey Consumers Company. It was, of course, a foregone conclusion, for although but few Shareholders were present at the meeting, the whole body have, with good reason, so much confidence in the Directors, that their sanction to the scheme was certain to be given. Happily, no discussion arose at this meeting as to the retiring allowances of the Directors and Auditors of the United Company; by the good sense of the South Metropolitan Shareholders they were passed over. The only opposition which now remains is that raised by the Phœnix Company, who object to the scheme proposed, as standing in the way of a larger combination. This Company might have had the matter entirely in their own hands, but they neglected their opportunity, which has now for ever passed away from them. What the Board of Trade may say we have no idea, but it cannot be supposed that they will endeavour to force any union between the Phœnix and the South Metropolitan Companies. There is one combination, however, which is still open to the Phœnix Company. They may, with much propriety, take all the district of the London Company south of the river, leaving to the Chartered Company all that lies to the north. This would prove a most valuable amalgamation. There might be some little difficulty in splitting up the amounts of capital to be allotted to the two Companies; but it could easily be settled by a calculation made by competent engineers. The London Company may be said to be an anomaly. How their districts were allotted, when the districting arrangements were made, we could never imagine. All the area north of the Thames now properly belongs to the Chartered Company, who have the means of furnishing a supply to the districts in that area, while that on the south would naturally fall to the Phœnix Company, who would profit by obtaining the large manufacturing power of the Nine Elms works. But the London Company show a great unwillingness to enter into any combination. It is, in our opinion, a short-sighted policy, and it is to be hoped the Directors will take into serious consideration the propriety of entering into some union with the Companies south and north of the Thames.

We are sorry to see that the Birmingham Corporation are about to appeal against the judgment of the Court of Queen's Bench in their attempt to set aside the award of Sir Henry Hunt. As the case is still *sub judice*, its legal bearings must not be referred to. We object to the process because all the expenses, whichever way the ultimate decision goes, will fall upon that unfortunate overburdened animal—the ratepayer. Birmingham, as we said last week, had an excellent bargain when the Corporation purchased the Staffordshire Company's works, and could afford to be generous. The principle of arbitration adopted by Sir Henry Hunt cannot here be commented upon, as, whether the fragments of the undertaking should be sold at a proportionate price to that paid by the Birmingham Corporation, or whether they should now be disposed of at their increased value, is a question which the Court of Appeal will have to consider. All that can be said now is that it will be a blessing when this litigation is settled, and the Local Authorities get their several undertakings into fair working order. As we intimated last week, some of them may not do well; but, reviewing the whole case, we consider that it would have been better for everybody if the whole undertaking had remained in the hands of the Company.

The electric light again attracts attention, and attempts are once more being made to write down the value of gas property. Much of the nonsense emitted is founded on the evidence of Sir William Thomson before the Select Committee on Lighting by Electricity, which we publish in another column. We have rarely seen a man of undoubted eminence and science fail so conspicuously to impress on his hearers the actual facts respecting the electric light. The first part of his evidence will be only intelligible to electricians, and we may pass on to such practical matters as stand out in the examination of the learned Professor. Sir William Thomson believes that the electric light has a great future before it, and no one can gainsay that; but there is still a doubt as to the source from which the electricity is to be obtained. Batteries, wet or dry, will not suffice. The employment of mechanical force, therefore, has to be resorted to, and the question is how the energy is to be obtained in the most economical manner. There is a choice between a steam-engine and a gas-engine, and Sir William Thomson appears to think that the former is the more economical. Among the immediate possible applications of the electric light, the Professor appears to think that it may be used to illuminate the drawing-rooms of noblemen's mansions. An engine of some kind may be placed in the basement, and, proper arrangements having been made, the drawing-rooms may be lighted with splendour. No scientific superintendence is considered to be necessary, but what Jeames Plush or John Thomas would say to having the management of a steam-engine, electric apparatus, and the supply of Jablochkoff candles added

to his already arduous labours, we cannot well guess. Nor can we imagine what would be the consequences if, when the Duchess of Piccadilly was giving a ball, the light should suddenly go out. Accidents of this kind are very common when the electric light is used, and, after all, perhaps gas would be found a preferable mode of illumination. With regard to Sir William Thomson's notions about lighting up tortuous passages and long corridors by the aid of mirrors and prisms, to reflect and distribute the light, we shall say nothing, because it is simply an idea which has never been reduced to practice. It will probably be very long before the electric light finds its way into our mansions and theatres. Very much requires to be done before it could possibly be introduced into the latter. A moment's darkness would create a panic among the audience, which might result in the death of numbers. We may therefore put aside the idea of lighting theatres, and mansions may be disposed of in a similar manner.

The distribution of electricity on a large scale naturally attracted the Professor's attention, and he indulged in some tall talk borrowed from enthusiastic Yankees. It is an old idea that the Falls of Niagara might be utilized in driving machinery, but no enterprising American has as yet attempted to carry it out. No doubt a large tract of country might be furnished with the electric light by the force of the Falls; but we have no expectation of living to see the day, or rather the night, when a part of the American continent will be illuminated by the electric light generated by the force of Niagara. Supposing water power should ever be brought into operation, we have a disposable force all round our coasts, sufficient to drive all the machinery in these islands. It is astonishing that the tides have been entirely neglected as a source of motive power. They come and go with the utmost regularity, and can always be depended upon. When our coal-fields show signs of exhaustion, this source of power will, no doubt, be utilized.

Retracing our steps for a moment, we may point out a singular notion entertained by Sir William Thomson. He advocates the use of copper tubes as conductors when electricity is to be used on a large scale, and, in order to keep these cool, and prevent them from fusing, he would send a continuous stream of water through them. The hot water thus obtained, he suggests, might be distributed to the houses along the route—a novel proposition, which excited some amusement. We shall not say that a supply of hot water is not desirable, but may remark that it is obtainable in the house of every inhabitant who possesses a kettle, and who can afford a scuttle of coals. At last Sir William Thomson was brought to the actual point towards which the inquiry of the Committee was, or ought to have been directed. Legislation, he appears to think, is at the present time only necessary so far as it would give free powers to Local Authorities, and to any company or body, to supply the light, and promote the progress of electric science. He seems to entertain a fear that if such powers were granted they might be used to obstruct rather than advance the progress of science. Corporations may be generally trusted, unless they have gas undertakings, to do the best they can in opposition to gas interests, and such opposition would necessarily involve earnest attempts to improve the electric light. But the proper course to pursue would be to give general powers to everybody who expressed a readiness to ruin himself by the exploitation of the light. Gas Companies, it is to be hoped, will never meddle with it. They have quite enough to do to perfect the manufacture and distribution of their own article, which should be their first consideration. After they have done this, they may, if circumstances favour, take up the business of supplying the electric light, and we see no objection to their having full powers to do so.

We have now done with Sir William Thomson, with whose evidence we were greatly disappointed. It was left to Mr. W. H. Michael, Q.C., to bring back the matter to the realms of legality and common sense. This gentleman's evidence, which we also publish to-day, was of so important a character, that any abstract of it would be unadvisable. We commend it in its entirety to the consideration of our readers, who will find in it very valuable information on legal points which concern Gas Companies and Corporations. With so eminent a lawyer as Mr. Michael, we cannot, of course, argue; but there are one or two points in his evidence which may be open to contention. However, the evidence, taken as a whole, contains so much valuable information, that it merits the most serious attention of our readers.

The inquiry of the Committee is now practically at an end. They meet again on Friday, but it is not likely that any fresh evidence will be taken, and the time of the Committee will most probably be employed in considering the terms of their report. We confess to having been greatly disappointed with the conduct of the proceedings. The Committee knew, of course, very little about the electric light, and still less about the law which regulates what we may call the distribution of light. Under such circumstances, it could not be expected that much information would be extracted which would enable the Committee to recommend what form legislation should take with regard to this growing art of lighting by electricity. Perhaps it ought to be added that they were not well assisted by the witnesses, and we shall look with much curiosity for their report.

We are always sorry to hear complaints against Gas Companies for which some real foundation is alleged; but at Stretford, allegations are made that the local Company carry matters with a very high hand, and do not particularly consider the interests of their consumers. It is alleged that a certain meter, accused of registering falsely, was examined, and reported by the Officers of the Company to register twenty-five per cent. slow. The same meter was subsequently forwarded to the Testing Office at Bootle Street, Manchester, from which a report was sent that the meter registered eleven per cent. fast. There seems to be great discontent with the Company in Stretford, which it is to be desired will soon be removed by the remedy of alleged defects. To such nonsense as that of pumping air into the mains, of course, we pay no attention. Ideas that adulterations of this kind are practised by Companies, are common enough; but no one acquainted with the art of gas-making and distribution will give the matter the smallest credence.

Water and Sanitary Notes.

We are sorry to see that dissensions have sprung up between the Liverpool Town Council and their able Borough and Water Engineer—Mr. G. F. Deacon. Under this gentleman's superintendence, the sanitary arrangements of Liverpool have been greatly improved, and an enormous waste of water has been effectually stopped. We need not say much on this latter point, because, although it has been resolved to separate the offices of Borough Engineer and Water Engineer, we may take it that Mr. Deacon's services will still be retained in the latter capacity. The ways of Corporations are rather mysterious. We do not find anything, in the reports which reach us, showing that Mr. Deacon has failed in the satisfactory performance of the duties of his double appointment, so there must be something behind this dislocation of offices. The waste-water meter may be at the bottom of it, but every man has a perfect right to make the fullest use of any invention he may produce, always supposing that his efforts are not inimical to his immediate employers. There is no allegation that the Corporation of Liverpool at all suffer from the extended use of the meter. They ought, indeed, to be proud that an invention from which they derive so much benefit originated in their borough. Mr. Deacon's services will presently be required when any new scheme for a supply of water to the town is brought up for consideration. The sewerage of the borough and district is still very incomplete, and the able assistance which the Engineer could give would be of the utmost value alike to the Corporation and to the inhabitants. It seems that much laxity has been exhibited in the superintendence of the construction of sewers, and that the contractors have failed to do their work in a satisfactory manner. But a Chief Engineer cannot be everywhere. With three important water schemes on his hands and in his head, he could hardly be expected to burrow underground to make a minute examination of brickwork; and, unfortunately, he seems to have been rather badly served by his assistants, who passed work of very inferior quality. We cannot think the Liverpool Corporation have lost any confidence in Mr. Deacon, but presume they think him overdone with work, and wish to relieve him of some of his labour. They will require his services presently, when the water schemes are further advanced.

The report of the Directors and the accounts of the Southwark and Vauxhall Water Company have been issued in anticipation of the half-yearly meeting to be held on Thursday next. It is gratifying to find this Company rapidly returning to a state of prosperity. For the present half year they can pay a dividend at the rate of five per cent., and carry forward a considerable balance. The business of the Company is being rapidly extended. In the course of the past half year they have laid 7688 yards of new mains, 290 of which are outside the Company's parliamentary district. It is certain that the circumstances of the Company, under able management, must continue to improve. We regret to see a number of changes in the Directorate, but may congratulate the Shareholders on the selection made to fill up the vacancies.

The London Vestries and District Boards have been taking into their consideration the Indemnity Bill which the Metropolitan Board of Works intend to promote, to relieve themselves

from the disallowance of the expenses of promoting the Water Bills last session. There is a certain unanimity of expression amongst these Local Authorities, but it can obviously have no effect. A conference of delegates, as suggested by the Vestry of St. George's, Hanover Square, may meet and discuss the matter; but they are quite powerless to render effective opposition to the Metropolitan Board of Works. The Indemnity Act is tolerably certain to be obtained, and we shall not object. It is sufficient for us to note the necessity for such a measure, for we believe, as a matter of fact, the law gives no power to surcharge the members with expenses illegally incurred. It will serve as a caution, and will for all time prevent the Metropolitan Board of Works from attempting to lay violent hands on the Water Companies.

It is gratifying to find that the health of London continues to improve. We have not as yet Dr. Frankland's report for last month, but as there were heavy floods up the river, we may pretty confidently anticipate that much turbidity, and not a few "living and moving organisms," will be heard of. However, let us note with satisfaction that, notwithstanding the inclement weather for the season, the health of London has been restored to what may be called its normal state—twenty-one per thousand. There can be no prejudicial influences at work when such a low rate of mortality, in a crowded population like that of London, is maintained. We notice further that in other small towns, the sanitary condition of which is infinitely inferior to that of the Metropolis, a very low death-rate was experienced. Surely this might teach those who pretend to tell us that the water supply has so much influence on health, that some other agencies must be at work which control the mortality.

It must be confessed that we do not understand the water affairs of Ely, which appear to be in a peculiar condition. The source, we believe, is the River Ouse, but the supply is not regarded as satisfactory. Complaints are made that the water is prejudicial to health, and a somewhat unusual proposal has been started. In order to improve its condition, instead of one filtering-bed near the source of supply, it has been proposed that no fewer than fifty filtering-tanks should be placed in the little city, from which the inhabitants may fetch the water, no one having to go more than a hundred yards for the purpose. We shall not characterize this idea as preposterous, whatever our readers may think about it. There is also a proposal to introduce a chalk water supply in the city; but Ely is poor, and its credit is low; therefore the chalk water scheme has to be deferred until better times arrive, which perhaps never will come to Ely.

THE WATER SUPPLY OF THIRSK.—Last Wednesday a meeting of owners of property and ratepayers at Thirsk was held to consider what further steps should be taken to oppose the Provisional Order granted by the Board of Trade to the Thirsk District Water-Works Company, the Confirmation Bill for which was recently unsuccessfully contested in the House of Commons. A motion, "That, in the opinion of this meeting, the Thirsk District Water Company having established their scheme to the satisfaction of the Select Committee of the House of Commons, it is unwise and inexpedient to offer any further opposition"—received the support of only ten persons present; while a proposal, "That this meeting much prefers the soft spring water from Kepwick to the Boltby surface waters, and pledges itself to give its best support to the opposition," was declared carried, between 200 and 300 hands being held up in favour of it.

A NEW NON-CONDUCTING LINING FOR GAS-STOVES.—Messrs. John Wright and Co., of Birmingham, have recently introduced into several of their gas-cooking stoves a jacketing, on the top, sides, and door, of a new and very efficient non-conducting material. Some idea of the value of it may, they say, be gathered from the fact that a teacupful of water (jacketed with three-eighths of an inch of silica) which at ten o'clock stood at 200° Fahr., had at two o'clock lost only 50° of its heat; and a jacketed cooker which had been alight for six hours, and the temperature of which inside the oven stood at 500°, was so cool on the outside that the hand could be borne upon it. Another advantage, besides the saving of gas, is that the kitchen is kept perfectly cool during the summer months. As to the economy of this new system of jacketing, the makers claim a saving of gas to the extent of 40 per cent. as compared with the cooking-stoves ordinarily in use. Experiments which have been made show that while with an ordinary gas-cooker a consumption of 20½ cubic feet of gas per hour is necessary to maintain a temperature of 380° Fahr. inside the oven, with the new cooker the use of only 12 cubic feet per hour is sufficient.

PRESENTATION TO MR. W. BELTON.—The workmen employed by the South Shields Gas Company, to the number of about 70, have presented a testimonial to Mr. W. Belton, who had been Assistant Engineer and Superintendent for upwards of six years, on the occasion of his being appointed Secretary and Manager to the Shrewsbury Gas Company. Mr. D. Wemyss, in presenting the testimonial, expressed the regret of the workmen at losing an officer for whom they all felt the greatest respect, and under whose superintendence they had long worked so comfortably. Mr. Hall, one of the Directors of the Company, expressed the regret of the Board at losing the services of a faithful and valuable officer, while they could not but be pleased that he had been chosen for a more advantageous post. The testimonial consisted of a beautifully illuminated address and a purse of gold. The address was as follows:—"Presented by the *employés* of the South Shields Gas Company (together with a purse of gold) to Mr. W. Belton, on the occasion of his leaving the above Company's employ, May 24th, 1879, as a token of the sincere esteem in which he has been held among them during his superintendency, and wishing him every success in the appointment he is about to enter upon, as Manager and Secretary to the Shrewsbury Gas Company, where, we feel sure, he will win the approbation of those around him. Signed, on behalf of the *employés*, Duncan Wemyss, Chief Inspector; John Henry Wood."

THE METROPOLITAN FIRE BRIGADE AND THE WATER COMPANIES.

THE debate recently initiated in the House of Lords by Earl Granville, on the subject of the Metropolitan Fire Brigade, has been duly followed by journalistic comments and communications. It is a little curious to find the noble Earl stating to his brother peers that only three months ago he was "profoundly "ignorant" of all that related to the protection of the Metropolis against fire. So much attention are our legislators accustomed to give to the local government of the "province covered "with houses," where they take up their abode for a certain portion of the year! The occurrence of a fire in his own dwelling aroused the attention of his lordship to the fact that there was an institution next door which had charge of what is called a "Fire Brigade." Possibly Earl Granville had heard of Captain Shaw, the gallant chief officer of the Brigade being not altogether a stranger at the West-end. No doubt the Earl had also seen a fire-engine. But to hear of Captain Shaw, and now and then to see a fire-engine rushing through the streets, is a very mild sensation compared with an irruption of firemen into one's own dwelling, and the appearance of the engines in battle array at one's own door. Earl Granville is very well satisfied with the performances of the Brigade on the occasion, and so far he ought to feel indebted to his near neighbours, the Metropolitan Board of Works. But it appears that after the occurrence of this exciting incident, somebody drew the attention of the Earl to a certain parliamentary report on the Metropolitan Fire Brigade. To Earl Granville the subject had all the charms of novelty, and, consequently, a few evenings ago, he was to be seen walking to his seat in the House of Lords with the aforesaid Blue-Book under his arm, from which he proceeded to address their assembled lordships concerning the peril of the Metropolis in respect to fire.

A celebrated humourist, no longer with us, has cleverly said that "there is a wonderful deal of human nature in most people." Lord Truro, having his hen-roosts rifled by Blackheath marauders, became zealous for the reconstitution of the police force. So Earl Granville, having had his house on fire, begins to think there is a necessity for strengthening the Fire Brigade. The Earl, moreover, has the advantage of finding his brief all ready for him. He has only to take up the Report of the Select Committee, and he is able to point out exactly what ought to be done. Those members of their lordships House who do not happen to have any official responsibility, all join in chorus, as if they feared the anonymous "Plot to Burn London" was only too likely to become a piece of real history. Lord Aberdare, who was famous for his zeal and promptitude when at the head of the Home Office, was fired with ardour at the address of Earl Granville, and called upon the Government to proceed without delay to carry out all that the Select Committee had recommended. The Earl of Beaconsfield—ominously designated as "Cæsar" by Earl Granville—had prudently walked out of the House at an early period, leaving Earl Beauchamp to make the best apology he could for undertaking nothing at present. There was a "free debate," certain noble lords hitting out briskly at whatever related to the water supply—the Earl of Shaftesbury summoning up the ghost of the departed General Board of Health, and making the Water Companies responsible for the drinking of "detestable beer" down at the East End; whilst the Earl of Camperdown finished off by a dismal prophecy that the debate would "lead to' nothing," and therefore he should "reserve to himself the right of proposing a resolution on the "subject at some future period of the session." This, probably, struck their lordships with a feeling of awe, for they forthwith dropped the subject, and proceeded to discuss their Standing Orders.

It may be said that in dealing with this question we are to be looked upon as "the organ of the Water Companies," as we have just been told that we are "the organ of the Gas Companies." Perhaps it is thought that there is a vast amount of argumentative power in the use of an appellation of this kind. Certainly there ought to be, seeing how much argument this phrase is often made to do duty for. But let our "official" or "semi-official" position be what it may, we should very much regret to oppose any reform which, if adopted, would promote the health or security of the Metropolis. We hope to bring to the discussion of this question a familiarity with the subject which will enable us to show how an improvement can be best effected. We are not for standing still, if the interests of the public are to be promoted by going on. Last December we pointed out that the Fire Brigade arrangements were not what they ought to be, and that London was not duly protected against fire. We were so far zealous, though we had not passed through the same fiery ordeal as Earl Granville. We consider it quite possible to im-

prove the present state of affairs in regard to this matter, and we believe this may be done by a much readier process than either Lords or Commons appear to contemplate.

There is nothing to show that the water supply of London is otherwise than ample for the extinction of fires. There is plenty of water, and the question to be solved is simply how to make this supply most readily available and most thoroughly effective. A variety of authorities, from Mr. Braidwood down to Mr. Edwin Chadwick, have asserted the principle that promptitude is all-important. Every fire is insignificant at first, the danger increasing each minute in a high geometrical ratio. Thus we learn: "In the first minute of ignition a jugful of water may suffice; "in the second, not a pailful; in the third minute, not three "or four pailfuls; and in a few minutes more, nothing will "suffice but supplies that can be applied only by engine power." Mr. Chadwick says: "Five minutes was the limit of time laid "down by Braidwood, in his evidence to us, as the limit of "time for relief to be effectual for the protection of life and "property." But Mr. Chadwick goes on to state that the runs from the Brigade stations, as maintained by the Metropolitan Board, average more than a mile and a half, and are not executed, at the quickest, in less than fifteen minutes, at the end of which period their requirement is 2000 gallons a minute, or a thousand pailfuls. The average distance thus given by Mr. Chadwick seems rather in excess, and yet the time occupied between the outbreak of a fire and the arrival of the engines is perhaps seldom less than ten or fifteen minutes. On the other hand, it is stated that in towns where the hydrant system has been adopted, and where the police are attached to the Fire Brigade, water is applied from the hydrants in little more than three minutes, or in less time than it usually takes to attach horses and start the Brigade engine.

We cannot help thinking that when Earl Granville made his speech in the House of Lords the other evening, he had read very little more of the case than is to be found in the "Conclusions" at the end of the Committee's report. At all events, we see no indications that his lordship had mastered the evidence laid before the Committee. It should be remembered that this Committee sat for two sessions, and the evidence taken in 1876 was very extensive. In July, 1877, Mr. Chadwick wrote a pamphlet reviewing the evidence given before the Committee, as well as citing information obtained from other sources. Mr. Chadwick is not likely to be suspected of any tenderness of feeling towards the London Water Companies, and, therefore, we may with the greater confidence commend his statements to the attention of our opponents. The impression left on Mr. Chadwick's mind by the evidence given before the Select Committee is very remarkable. Mr. Chadwick was himself called as a witness, and he states concerning his own evidence: "The position taken by the Board "of Works, that hydrants would be of no use on account of "the insufficient pressure on the mains, I met by the positive "assertion that hydrants would be of great use, even if the "pressures were sufficient only to deliver water at the base-"ments of the houses, seeing that some seventy per cent. of fires "were put out by the police in Manchester by a bucket with "a hand-pump; but I averred that there were good available "pressures obtainable over the greater part of the Metropolis." On this latter point Mr. Chadwick was able to state what he had seen with his own eyes, in addition to which there was evidence from the City Engineer, Lieut.-Col. Haywood, and the Engineers of several of the Water Companies.

In his pamphlet, Mr. Chadwick says: "The evidence given "by Mr. Dickson, the Secretary of the Kent Water-Works "Company, appears to me to involve the most grave incrimina-"tive facts, calling for particular attention." According to Mr. Chadwick, it was shown by Mr. Dickson that as early as 1866 the Company, in answer to complaints of the late attendance of turncocks at fires, represented to the Metropolitan Board that such complaints might be more than obviated by putting down hydrants on the mains, which were ready under constant pressure to receive them. "These representations "were renewed from time to time." At last the Company gave regular notice to the Board that they would fix hydrants, but the Board, for some reason or other, asked that the notice might be withdrawn. The Company refused to withdraw the notice, and persisted in putting down a number of specimen hydrants; after which a Committee of the Board attended to witness a trial of the new appliances, accompanied by Captain Shaw, who pronounced the hydrants to be satisfactory. With the greatest possible discouragement from the Metropolitan Board, the Kent Company proceeded to extend the hydrant system in their district, and with such good results that the fire-engines were very generally superseded. The extraordinary conduct of the Metropolitan Board in reference to this matter can only be appreciated by a perusal of Mr. Dickson's evidence *in extenso*. We venture to say that if the Metropolitan Board had been intent on the introduction of hydrants, and the obstructiveness had emanated from the Water Company, the latter would have been overwhelmed with odium, and justly so. We find the Board on one occasion actually putting in a "protest" against the introduction of hydrants, declaring that they were "quite unprepared" for such a thing, and that in regard to the locality specified "there was no need for them." Nevertheless, the Company proceeded to put down the hydrants, sixty in number, in the Plumstead district, and the Metropolitan Board paid for them, as required by the Act. Virtually, the "protest" was an attempt to set aside the law, while the subsequent payment was an admission that the Company acted according to the statute. If the Metropolitan Board had prevailed, the Act of 1871 would so far have been rendered inoperative, and the intentions of the Legislature would have been frustrated.

The Select Committee, in their report, recognize the value of the hydrants as affording a more ready supply of water than plugs, even in those cases where engines might still be requisite. Thus they say: "Several instances have been brought to the "notice of your Committee, where fires have been ineffectually "dealt with, from the engines having to wait for a supply in the "service-pipes, or from such supply proving insufficient, whilst "close at hand was the main, with abundance of water, which "could have been immediately available if only there had been "a hydrant." In addition, where there is a pressure of water, the hydrant itself takes the place of the engine. The value of the hydrant system was the subject of very strong testimony from Mr. Swanton, "even with the water supply in its present "condition," as Mr. Chadwick observes. On this point Mr. Swanton, who is the Superintendent of the London Salvage Corps, ventured to set his own practical experience against the conclusions arrived at by Sir Joseph Bazalgette. When asked, "Will you state to the Committee, from your knowledge, where "those conditions exist under which, in your opinion, hydrants "could be affixed to the mains?" he replied, "I should say over "at least two-thirds of the whole of London." To this the witness added, "I am sure of it, from what I have seen."

The Committee admit in their report that there are many districts in the Metropolis "where hydrants could be used as "engines, if affixed to mains, or even to service-pipes." Of course the City affords a notable example, the Corporation having commenced to cover the whole of their jurisdiction with hydrants. But the Committee express their opinion that the case is different "with the Metropolis at large." At the same time, the Committee aver that a hydrant may be very useful, even though it act "as a mere carrier of water to the door of "the house, as by this means hand-pumps can be at once set to "work." "The efficacy of hand-pumps so used," it is stated, "is fully proved by the experience gained at Manchester, where "seventy-two out of three hundred and eight fires were extin-"guished by such means." But now comes in the "essential "condition" that there should also be on the spot "persons "ready and competent" to work the hydrants. For this purpose the aid of the police is invoked. The Committee recommend that the Fire Brigade should accordingly be transferred to the Commissioners of Police for the Metropolis, so, however, as to constitute a distinct branch under a separate Assistant Commissioner, who shall be authorized to act within the City of London, as well as in the Metropolitan area. It is also proposed that the halfpenny rate should be enlarged to a penny. "Hydrants," it is added, "should, without delay, be affixed to "mains and service-pipes wherever there is a constant supply, "and should follow the extension of such supply."

Whether an actual transfer of the Fire Brigade to the Police Department is really necessary may be doubted. For the present we cannot enter into a discussion of that point. But, so far as we have gone, there is nothing which involves the necessity of any change in regard to the Water Companies themselves. Mr. Swanton, speaking in the interest of the Insurance Offices, is very desirous that London should be well protected against fire, but he sees no necessity for consolidating the Water Companies, much less for superseding them. In the evidence of Mr. G. W. Lovell, Secretary to the Phœnix Fire Office, and Chairman of the Salvage Corps, we find it stated that certain points on which the Insurance Offices felt anxious were as follows:—The introduction of "small" floating engines on the Thames; the necessity of having turncocks kept at each of the Brigade stations, the Water Companies paying for their lodgings; and the junction of the different Companies supplies, in order to bring to bear the whole of the resources upon any one point. It was the complaint of Mr. Lovell that whereas these matters had been frequently pressed on the notice of the Metropolitan Board by the Fire Offices, the Board had in no instance granted the requests

thus made. So hopeless had the task of applying to the Metropolitan Board become, that Mr. Lovell dreaded the idea of making any further application. The Board appeared to be simply immoveable, though they have taken some step towards supplying a more handy kind of floating engine on the river.

Seeing where the obstruction has hitherto existed, and where the willingness to act has been found, we ask whether all that is required cannot be obtained without contemplating anything so formidable as "buying up" the Water Companies, and "consolidating" their undertakings in the hands of a public authority. Of course, if the Companies are to be superseded, consolidation follows. But amalgamation, more or less, can be accomplished on the present basis. This latter process may be desirable, but it is certainly not essential, so far as the prevention of fire is concerned. One great safeguard to the Metropolis, in respect to fire, consists in the variety of the sources from whence the water supply is drawn. This diversity should be continued, for the sake of the security which it confers. A junction between the various systems is calculated to be of great utility, and, to some extent, it already exists. Whatever more is wanted can be assuredly obtained without any heroic effort for the purpose. It would seem that the local government of London is to be revolutionized in order that the Metropolis may not be laid in ashes. Yet simple means lie close at hand, which would give all that is requisite. Unquestionably at the present hour a vast amount of avoidable danger exists, and year by year there is a large sacrifice of property, not because the Water Companies fail in their duty, but because the Metropolitan Board will not take any action under the present *régime*. The evidence before the Select Committee, and the recital in Mr. Chadwick's pamphlet, must be considered as telling heavily against the Metropolitan Board, and as affording a remarkable testimony to the public spirit of the London Water Companies. In regard to this fire question, not a single charge lies against the Companies, and it seems strange that it should be thought necessary to sweep them away in order to strengthen the hands of the Fire Brigade. That the Brigade needs some strengthening is clear enough, and its weakness is one argument why the hydrant system should be extended without delay. Come what will, the hydrants will be wanted, and if at present they cannot be put everywhere, they can be adopted to such an extent as to add immensely to the security of the Metropolis.

As a valuable corrective to the Report of the Select Committee, we would direct attention to a recent letter in *The Times* from "A County Chief Constable," which clearly shows that large communities can be efficiently protected against fire without any transfer of the water supply to the Local Authorities. Whether such a transfer may for other reasons be thought desirable, is a question we need not now discuss. All we need contend for at present is this—that an efficient scheme for the protection of London against fire is quite consistent with the continuance of the water supply in the hands of the Companies. The "County Chief Constable" says: "I established a plan "of co-operation and mutual assistance between the Water "Companies, the Fire Offices, and the Municipal Corporation," and he states that these parties "co-operated in every sense in "making the plan thoroughly efficient." It is true that in this case the Fire Brigade was made to form part of the Police Force; but there is no intimation that any need was felt for transferring the water supply to the Local Authorities. The value of the Police was experienced in affording the requisite agency for a prompt use of the hydrants. Whether this necessitates an actual absorption of the Brigade in the Police Force is a matter for debate; and we find Mr. Swanton, in his evidence before the Select Committee, expressing views favourable to a continued distinction between the London Police Force and the Metropolitan Fire Brigade, the Police simply taking charge of the hydrants until the arrival of the Brigade. But one consideration which grows directly out of the experience of the "County Chief Constable" who writes to *The Times* is this—that a system of conjoint action between the Water Companies and the Local Authorities renders any proposal for superseding the former unnecessary. The want of such co-operation in London is most unquestionably a state of things for which the Companies are not responsible.

Proposed Purchase of the Eckington Water-Works.—At the meeting of the Chesterfield Rural Sanitary Authority, on the 31st ult., it was stated by their Clerk (Mr. Haslehurst) that he had asked their Engineer (Mr. Frith) to make a valuation of the Eckington Water-Works, with a view to their purchase by the Authority. Mr. Frith had done so, and the value he placed upon them, including houses, workshops, &c., was £4925. The Clerk added that he had also written to the Directors of the Water Company, inquiring the price at which they were willing to sell, and, in reply, they stated that they were willing to accept the sum of £5000. After some discussion, it was resolved that the Authority should purchase the works for the amount asked, if the Local Government Board approved.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CLXXXI.

THE TREATMENT OF RESIDUAL PRODUCTS.

The Manufacture of Ammonia Salts from Gas Liquor.

The salts of ammonia which are prepared from the weak ammoniacal liquid produced in gas-works, and technically known as "gas liquor," are the sulphate, the carbonate, and the chloride; the first-named compound being, however, prepared in by far the greater quantity. The sulphate is also, of all the salts of ammonia, that which can be prepared, in a comparatively pure form, with the least plant, and at the least cost, and it has also by far the greater number of useful applications; for, besides its extensive use for agricultural purposes, it is largely employed for the manufacture of most of the other preparations of ammonia in a pure form. The present article will, therefore, be mainly devoted to a description of the various methods employed for the production of the sulphate of ammonia, leaving the other ammonia salts for after consideration.

Various plans for the treatment of gas liquor for the manufacture of sulphate of ammonia have been practised, the exact nature of each being dependent on the degree of purity required in the eventual product, and on the necessity for the avoidance of nuisance. Omitting minor details, such as slight variations in mechanical construction and arrangement, the methods of manufacturing sulphate of ammonia from gas liquor may be divided into three distinct systems, which may be enumerated as follows:—

1. Direct neutralization of the liquor by the addition of sulphuric acid.
2. Distillation of the liquor in boilers, the ammoniacal vapours evolved being absorbed by acid contained in a separate vessel, called a saturator.
3. Continuous distillation by the use of modified forms of the Coffey Still, the evolved ammonia being treated as in system 2.

The first of these methods is by far the simplest in operation, although having many contingent disadvantages. By this plan the gas liquor is allowed to stand for some time in order to separate suspended tarry impurities, and is then run into large vats, where it is neutralized by the addition of sulphuric acid. The addition of the acid decomposes the sulphide and carbonate of ammonium present, with fixation of the ammonia and expulsion of carbonic acid and sulphuretted hydrogen gases. These are either allowed to escape into the open air, or are conducted by means of a pipe into a furnace or chimney-shaft. The reactions which occur in the neutralization of the liquor may be represented thus—

$$NH_4O,CO_2 + HO,SO_3 = NH_4O,SO_3 + CO_2 + HO.$$

$$NH_4S, HS + HO,SO_3 = NH_4O,SO_3 + 2HS.$$

Any hyposulphite of ammonia which is present in the liquor is also at the same time more or less decomposed, with separation of sulphur and liberation of sulphurous acid, thus—

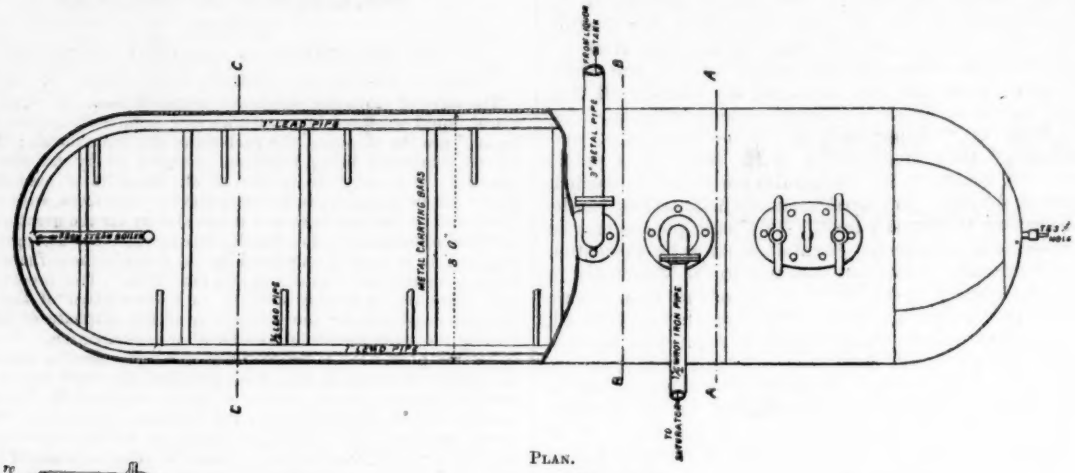
$$NH_4O,S_2O_2 + HO,SO_3 = NH_4O,SO_3 + HO + SO_2 + S.$$

The sulphuric acid is added to the liquor until it has acquired a faint but distinctly acid reaction, and mechanical agitation is frequently used to facilitate the expulsion of the liberated gases. The treated liquor is allowed to stand for some hours, and subsequently run off into evaporating vessels, where it is concentrated in order to obtain the sulphate of ammonia in a crystalline form. The crude product may be afterwards purified by resolution and re-crystallization.

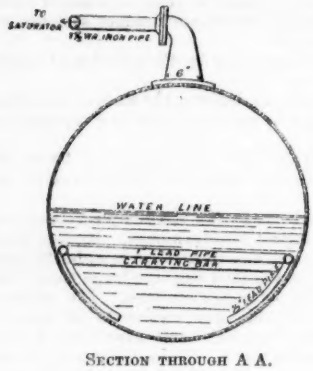
The method of which the above description is a rough sketch is now seldom used, the disadvantages, as compared with the modern improvements, being numerous. The expenditure of fuel is considerable, nearly the whole of the water of the original gas liquor having to be evaporated; and the product subsequently obtained is more or less dark in colour, from the tarry substances present, and impure, from the presence of foreign ammonia salts.

The second system of treating gas liquor possesses many advantages over the method just described, and enables a pure salt to be obtained without difficulty by a single operation. The liquor is placed in a boiler of suitable size, and heat applied either directly by means of a furnace and suitable setting, or indirectly by coils of pipe through which steam is allowed to circulate. The effect of the application of heat is to cause the evaporation of the ammonia present, as well as of the more volatile compounds, such as the carbonate and sulphide, together with more or less steam. The mixed vapours are conducted by a pipe to a vessel known as a saturator, and which has been previously charged with sulphuric acid. Saturators are of two kinds—viz., those in which crystals are formed direct, and in which there is necessarily some contrivance for their periodical removal without interrupting the continuity of the manufacture; and those whose function is simply the formation of a solution of sulphate of ammonia, from which crystals of the salt are subsequently obtained by evaporation in an exterior vessel. In the first description of saturator, a comparatively strong acid is employed, while in the second form of vessel a dilute acid is used. The saturator used for the direct production of crystals is generally a square or oblong vessel lined with sheet lead, and containing a central partition, which extends from the top to within a few inches of the bottom, so that when the vessel is charged with liquid acid it is virtually divided into two compartments. Into one of these compartments passes the pipe from the boiler, the end dipping into the acid, and being flattened out into a sort of disc, which is perforated with holes. A second pipe serves for the exit of the waste gases

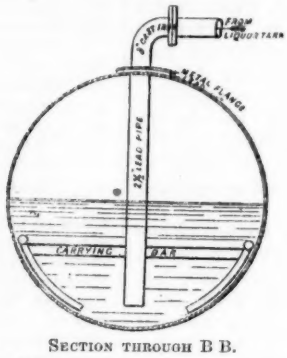
APPARATUS FOR THE MANUFACTURE OF SULPHATE OF AMMONIA.—Scale ½ inch = 1 foot.



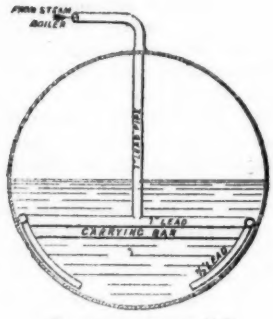
Plan.



Section through A A.

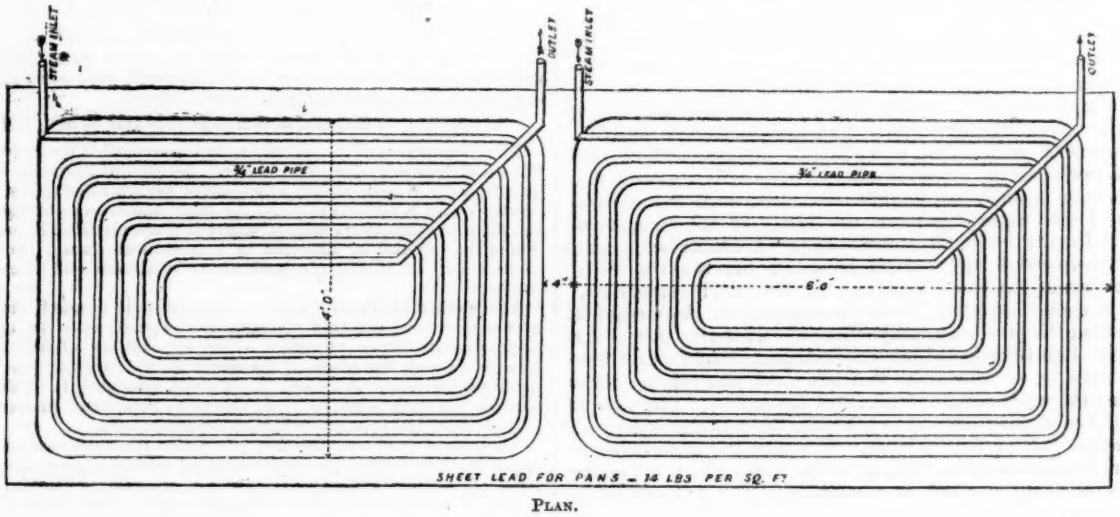


Section through B B.



Section through C C.

LIQUOR BOILER—12 feet long, 3 feet diameter.



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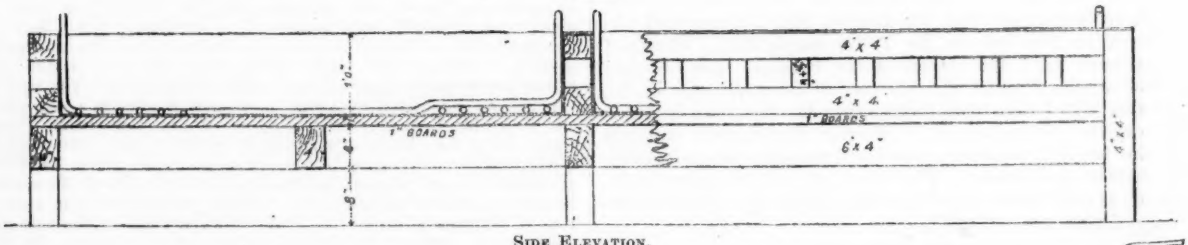
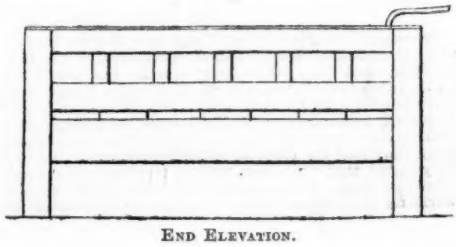


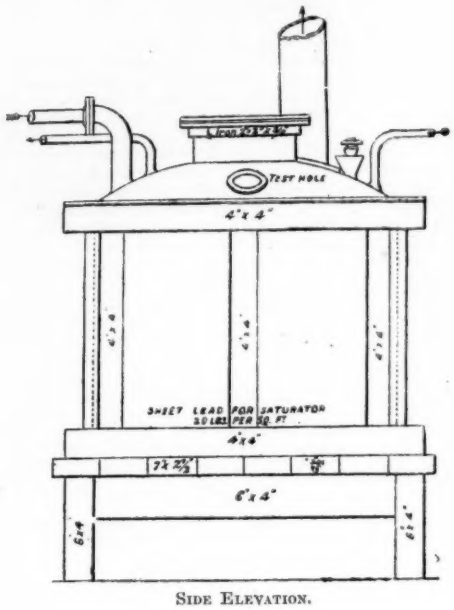
Side Elevation.



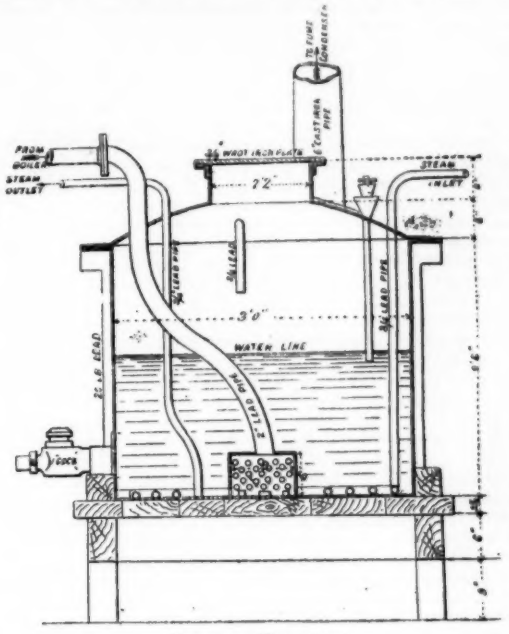
End Elevation.

EVAPORATING PANS—Each 6 feet long, 4 feet broad, 1 foot deep.

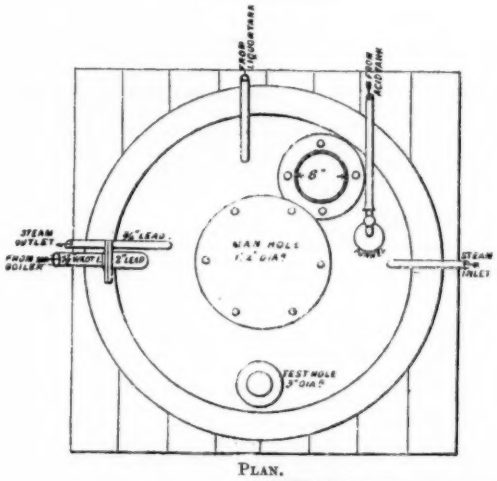
APPARATUS FOR THE MANUFACTURE OF SULPHATE OF AMMONIA.—Scale ½ inch = 1 foot.



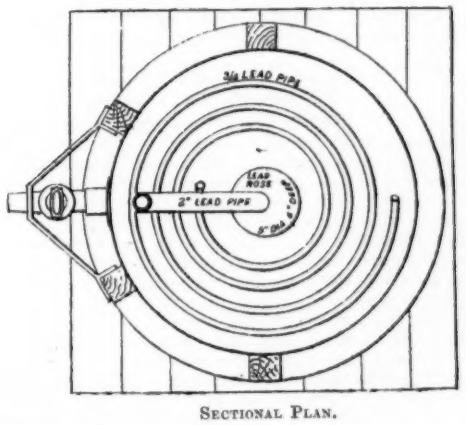
Side Elevation.



Sectional Elevation.

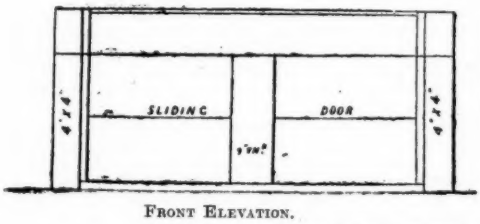


Plan.

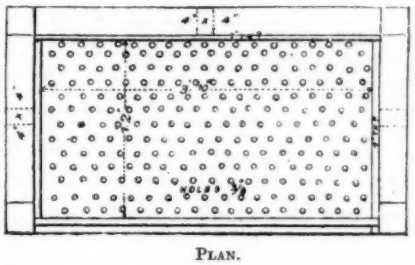


Sectional Plan.

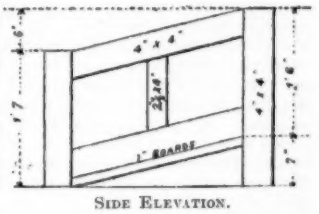
SATURATOR—3 feet diameter, 2 feet 6 inches high; crown 6 inches high.



Front Elevation.



Plan.



Side Elevation.

SULPHATE STRAINER—4 feet long, 2 feet broad, 1 foot 6 inches deep.

and uncondensed steam. The other compartment of the vessel is open at the top, or simply provided with a hinged cover, and it is here that the crystals of sulphate of ammonia are periodically removed.

In the saturator the ammonia is absorbed by the sulphuric acid, while carbonic acid, sulphuretted hydrogen, and uncondensed steam pass on. As the sulphuric acid becomes neutralized by the ammonia, the sulphate of ammonia formed precipitates in the form of small crystals, which are periodically removed by a perforated ladle or shovel, and placed on sloping tables of lead to drain for about 24 hours, after which they are removed and stored in a dry place. The liquid which drains from the crystals, being rich in ammonia, is returned to the saturator, and thus utilized. The gases and steam issuing from the saturator are passed through a condenser, which generally consists of coils of lead pipe immersed in cold water, and finally the comparatively dry gases are passed through the boiler furnace, in order to destroy the sulphuretted hydrogen, and thus avoid nuisance. The distillation of the liquor is continued until the evolved vapour is no longer markedly ammoniacal. A small further yield of ammonia may be obtained from the liquor by the addition of a little lime, which has the effect of decomposing the fixed compounds of ammonia present.

The employment of a more diluted acid in the saturating vessel, in which case crystals of sulphate of ammonia are not directly formed, but are subsequently procured by the evaporation of the liquid in open pans, is said to possess many advantages. When there is employed in the saturator an acid of such strength that solid sulphate of ammonia is formed direct, the crystals are continually being removed from an acid liquid, more or less of which remains adhering even after complete draining. The eventual effect of this adhering acid is to render the salt deliquescent, so that in the event of its being stored in any place which is in the least degree damp, a continual loss occurs from the absorption of moisture from the surrounding air, and the partial liquefaction of the crystals.

Another objection which has been raised to the use of a comparatively strong acid in the saturator is that the absorption of ammonia does not appear to be so complete as when a more diluted liquid is employed, so that a continual loss accrues from this source. A further objection to the use of strong sulphuric acid, which has been mentioned, remains to be noticed—viz., that the salt eventually

obtained is not so white as that procured when dilute acid is employed, a result which might possibly arise from the partial decomposition and charring of traces of tarry matter carried over from the heated liquor by the steam and ammoniacal vapours. When a comparatively dilute acid is employed, a perfectly closed saturator is used, no provision being needed for the removal of crystals. It may be either square or circular, the latter form being that to which the preference is now given. It is furnished with the necessary pipes for the entrance of the ammoniacal vapours, and for the exit of the waste gases, besides which means are provided for the introduction of acid, and for the withdrawal of the solution of sulphate of ammonia subsequently formed. The evaporating pans are, as a rule, simply oblong vessels lined with sheet lead, and provided with coils of lead pipe, through which steam from a boiler is made to circulate. The evaporation is carried on as nearly as possible continuously, the solid sulphate of ammonia being periodically removed and placed on sloping tables to drain, and subsequently stored.

The manufacture of sulphate of ammonia, by the method above described, affords small gas-works means of profitably utilizing their ammoniacal liquor, and of converting it, with very little expenditure of plant or labour, into a product which commands a ready sale, and realizes a good price. [Engravings illustrating the whole of the plant necessary for manufacturing sulphate of ammonia by this process are given on the preceding pages.] The only disadvantage to the process is that it is not continuous in operation; but this objection might be easily obviated by the employment of two boilers, so that the contents of the one might be undergoing distillation while the other was receiving its charge, the two boilers being thus used alternately.

The improvements which have been effected of late years in sulphate of ammonia manufacture have been principally in the direction of rendering the process continuous in place of intermittent; in economizing the expenditure of fuel, and in the adoption of more efficient means for the prevention of any nuisance arising from the waste gases from the saturator. In the last-mentioned detail it must be confessed that much improvement remains to be made, the methods most generally employed at the present time being fairly efficient for the prevention of nuisance, but objectionable on the ground of want of economy, the whole of the sulphur present being wasted instead of being utilized. A plan by which the utilization may be effected will be noticed hereafter.

CHEMICAL MANIPULATION.*

Since Mr. Williams's "Handbook of Chemical Manipulation" was published, enormous progress has been made in the science of chemistry. An alliance has sprung up between pure physics and chemistry, and the author ably states the case when he says that a chemist must be a physicist, and the physicist a chemist. The additions made to our knowledge of analytical processes and the means by which they may be carried out have within the last few years been very large, and the student of chemistry who desires to keep pace with the progress of the science will find, in the pages of the *brochure* we are noticing, full details of all that has been devised and discovered within the last few years.

It would be out of place, in our columns, to attempt anything like a criticism of the contents of the book, for, as a rule, gas managers and others who consult the JOURNAL OF GAS LIGHTING are not profound chemists; but for such who have a taste for the pursuit, we can strongly recommend this little book. We may briefly, however, notice its contents. The section on the determination of melting points contains instructions which will be useful to many managers, who go in for determinations of naphthalene, anthracene, and other allied bodies. Another section, on "Volumetric Manipulation," illustrates the value of Lunge's tests for discriminating between alkaline and acid reactions. This will probably be found extremely useful when valuations of ammoniacal liquor are made. One of the most interesting and valuable sections of the book is that on specific gravities, the most modern means of ascertaining which are fully detailed, including that for the determination of the specific gravities of gases. All our readers who are anxious to arrive at scientific precision will do well to consult the full instructions given in this little work. The processes in common use we regard as sufficiently precise for general purposes; but when scientific accuracy is desirable, we may say that something more than the rough-and-ready methods of Schilling's modification of Bunsen's apparatus is wanted. For such accurate determinations, full instructions are given in the work we notice, and we commend them to the notice of our readers. The important improvement in methods of organic analysis, and the apparatus employed, also receive full notice. The student of chemistry will note the changes which have taken place in the methods of chemical manipulation.

WASTE OF WATER IN EXETER.—A report recently presented to the Exeter Town Council by the City Surveyor (Mr. Boulnois) states that the waste of water in the city on the 5th of April last amounted to about 2150 gallons per hour, or at the rate of nearly 60 gallons per head per day. On an inspection of one district, 63 houses were found to be without stop-cocks; but in such cases as could be discovered where waste took place, a notice was served on the occupier of the premises to make the necessary repairs, the result being that on the 20th of April a diminution of the waste was found to have been effected, amounting to 1400 gallons per hour in the district. The City Surveyor also stated that while so large a waste of water was allowed to continue unchecked, it would be impossible to give a constant supply generally throughout the city, but that in those districts where meters were fixed it would be possible to give a constant supply, provided the waste was found to diminish.

* "Supplement to a Handbook of Chemical Manipulation." By C. Greville Williams, F.R.S., &c., &c. London: John Van Voorst. 1879.

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

THE ANALYSIS OF GAS COALS.

SIR,—I have perused with considerable interest the discussion now taking place in your JOURNAL upon the discrepancies which are usually found to exist between the scientific report upon samples of coal, and their practical value as realized at a gas-works. I may say that my own experience is corroborative of this fact, but I am slightly at issue with your various correspondents as to the cause of the discrepancy.

Mr. Paterson regards the laboratory experiment as giving the *absolute* value of coal, and that if the alleged results were not obtained in practice, any deficiencies were due to imperfections in the manufacture. I scarcely think this is the real explanation, for the apparatus used in experimental trials is not, as a rule, calculated to give the best results from the coal, no exhauster being employed, and the retort often working with all the back pressure of purifiers, &c., upon it. This pressure necessarily tends to a partial decomposition of the richer hydrocarbons, and consequent loss of illuminating value. Taken altogether, I should certainly consider the plant of a well-managed gas-works to be quite as competent to get the best available result from a coal as any ordinary experimental apparatus.

The real cause of the discrepancy often found to exist between the results of the gas manager and those of the analyst is, I believe, most probably due to a variation in the coal itself. The analyst receives a box of coal which he tests, and upon which he makes a report. The particular sample submitted to him is not likely to be an inferior one, and is, in all probability, a selected specimen, representing perhaps the best of the seam instead of the average. His report, made with all honesty, simply expresses the results which he obtained from the particular specimen of coal submitted to him, and if the dealer subsequently uses this report as representing the *average* composition of the coal, it is he alone who is to blame.

A short time ago I had a case which may bear out my argument. A large quantity of coal of a certain kind was delivered, and I carefully tested a fair specimen in an experimental apparatus, having two retorts, each of which was charged with 7 lbs. of coal. I obtained a result lower both in quantity and quality than that assigned to the coal in a printed circular by the dealers, and the figures of which were those of an analysis made by a gentleman whose skill and, I hope, whose honesty are beyond question. A repetition of my experiment gave a similar result, and I could only assume as explanation that the sample submitted to the analyst was a more favourable specimen than mine, which, being taken from a large bulk, represented a fair average.

H. LEICESTER GREVILLE, F.C.S., &c.,
Chemist to the Commercial Gas Company.

Stepney, June 6, 1879.

THE RECENT TRIALS OF GENERATOR FURNACES AT MUNICH.

SIR,—Having made some inquiries regarding the experiments in introducing steam into generator furnaces, which were reported in the *Journal für Gasbeleuchtung*, and which have been brought under the notice of your readers in the papers contributed by "Isca," I am informed that the trials conducted at Munich were made with furnaces of Dr. Schilling's construction, the well-known Engineer of the gas-works of that town, and the Editor of the *Journal für Gasbeleuchtung*.

It appears that Dr. Schilling uses coal obtained from the Saar Valley, in Prussia, and that he experienced considerable difficulty with the slag or clinker in his furnaces, as, when coke produced from Saar coal is used for fuel, the slag melts very quickly, and runs from the bottom of the furnace leaving the brickwork clean, and exposed to the action of the fire. Where generator furnaces are used, it is necessary that the slag should be maintained in a semi-melted condition at the lower part of the furnace, so that a covering of slag or clinker always remains upon the brickwork, to protect it from being destroyed, otherwise the intensity of the heat generated rapidly burns away the interior of the furnace, and especially the brickwork surrounding the inlet for the air supply, thus altering the form of the furnace, and destroying its efficiency.

The application of steam, it was believed, would cool the slag, and remedy this evil resulting when the coke from Saar coal was used. This expectation was, to a great extent, realized; the clinker thus artificially produced being also easily removed, as it was friable, and did not adhere to the brickwork as is usually the case. The results, however, showed that the introduction of steam into the furnace was not otherwise beneficial to the working, for, notwithstanding the fact of the partial decomposition of the steam into its component gases, there was no saving in quantity of fuel required, the steam absorbing at least as much heat in its decomposition as the combustion afterwards produced by the liberated hydrogen and oxygen generated.

From these experiments it resulted that the quantity of steam required to give the desired effect amounted, when Saar coal was used, to 70 per cent. of the coke used for fuel—*i.e.*, for every 100 lbs. of coke, 70 lbs. of steam were consumed. From this it may be seen that a large boiler, with all its additional working expense, is a necessary addition to Schilling's furnace.

The difficulty of dealing with the slag, and controlling the degree to which it becomes melted in the furnace, has been the great obstacle to the determination of a suitable regenerator furnace for heating retorts. A retort setting cannot be stopped in its working every few days to be repaired, nor can a generator furnace be allowed to burn itself out, as is usually the case with our ordinary furnaces, until it becomes twice as big at the end of a winter season as it was originally. To prevent this and preserve the furnace, especially the inlet for the air supply, from becoming burnt away, the semi-melted slag must form a coating over the brickwork, which will effectually protect it from the action of the fire, yet the slag must not so far congeal as to become clinker, and block up the air channel of the furnace.

Success has attended Mr. George Liegel, of Stralsund, in his furnace

improvements in this respect, more than any other inventor of regenerative retort furnaces. With his generator no coal has yet been found which cannot be successfully dealt with.

At the gas-works at Berne, in Switzerland, the same coal from the Saar Valley is used as at Munich. There Liegel's generator has been at work for three years, and the results compare favourably with those obtained at Munich, no steam supply having been found necessary.

In Munich, with Dr. Schilling's furnaces, the working results were as follows:—

Coal carbonized per diem in one setting of eight retorts	7336 kilos. = 6½ tons.
Gas produced per 100 kilos., 29·88 cubic mètres	10,200 cubic ft. p. ton.
Gas produced per retort per diem, 274 cubic mètres	9590 cubic feet.
Fuel used per cent.	17·67.

At Berne, with Liegel's furnaces, the average results are as follows:—

Coal carbonized per diem in eight retorts	6915 kilos. = 6¼ tons.
Gas produced per 100 kilos., 33·26 cubic mètres	11,460 ft. per ton.
Gas produced per retort per diem, 279 cubic mètres	9760 cubic feet.
Fuel used per cent.	16·08.

It is evident from these results that at Berne the retorts are better heated than at Munich, and that more work is obtained from them at a somewhat less expenditure of fuel.

The Liegel furnace is not only adopted in several European countries to a large extent, but is now being introduced into America, and in a few weeks time retorts will be heated on this system in one of the gas-works at New York.

Gas-Works, Peterborough, June 3, 1879. G. E. Stevenson, A.I.C.E.

Parliamentary Intelligence.

HOUSE OF COMMONS COMMITTEE.

Friday, May 16.

(*Before Mr.* Otway, *Chairman; Mr.* A. Smith, *Captain* Hood, *and Mr.* D. Taylor; *Mr.* A. Bonham-Carter, *Referee.*)

PLYMOUTH AND STONEHOUSE GASLIGHT AND COKE COMPANY BILL.

Mr. Pope, Q.C., and Mr. Michael, Q.C., appeared for the promoters; Mr. Cripps, Q.C., and Mr. Chandos Leigh for the Corporation of Plymouth and the East Stonehouse Local Board, petitioners against the Bill.

Mr. Michael, in opening the case on behalf of the promoters, said the object of the Bill was to enlarge the powers of the Plymouth and Stonehouse Gaslight and Coke Company, which Company might be said to be a *bête noire* to all other companies in the matter of the price charged for gas, because they had been cited as charging less than any other company in the kingdom, and had been held up as an instance of economical management for other companies to imitate. The local authorities were now, however, endeavouring to prevent the Company from deriving any legitimate advantage from their business in its natural extension. The capital of the Company was £95,000, of which £75,000 was authorized share capital, and it was sought in the Bill to raise £60,000 additional capital, with borrowing powers amounting to £15,000. It had become necessary from time to time to extend the works, to meet the growing requirements of the town and population. Under the auction clauses the maximum price would be fixed, and, after the division of a certain proportion of the profits, the remainder would go towards a reduction of the price of gas. Before the auction clauses were adopted it was considered sufficient to fix the maximum rate of dividend, and that originally was fixed at 10 per cent. It was then reduced to 7½ per cent., and now it was only 5 per cent. Afterwards the sliding scale came into operation, and provided a standard price. The price charged at the present time was 2s. 3d. per 1000 cubic feet, which was considerably less than in any other part of the United Kingdom. Under the Bill it was asked that the standard price should be fixed at 2s. 9d., or 6d. above the present rate, in order to meet what would be inevitable on a return of general prosperity to the country, viz., an increased cost of coal, labour, &c.—in fact, a higher rate for all materials used in gas manufacture. The cost of the production of gas would be shown to be 2s. 8d. per 1000, and, therefore, the margin of profit would be extremely little. Under any circumstances, the maximum price would be 3s. 4d. per 1000. With regard to the petition of the Corporation, the portion of the Bill referring to the electric light had been abandoned, and wisely, he thought, in the stage in which the electric light now was. Indeed, it would be very many years, he thought, before any gas company would think it worth their while again to take up that matter. It was alleged by the petitioners that the dividend was fixed at 7½ per cent., but as this had been altered to 7 per cent., he presumed nothing more would be said on that point.

Mr. Cripps said it was only since the previous Saturday that the Corporation had received the amended Bill, and they had had no time to consult the ratepayers. He, therefore, appeared as opposing the original Bill.

Mr. Michael said paragraph 8 of the petition set forth that the present authorized capital under the Act of 1845, bearing a maximum dividend of 10 per cent., was £95,000, but that was merely a state of facts with which he would not quarrel. The petition, however, further alleged that the Company had expended out of revenue large sums for works properly chargeable to capital, amounting in all to £52,000. Such a charge was quite unprecedented in his experience; and, as a matter of fact, had no foundation whatever. If that £52,000 so expended had been raised in capital, as it was alleged ought to have been done, it would have entailed a loss of £72,000, and an additional burden of over £4000 in perpetuity of accruing interest. A gas company, in estimating whether a certain amount of work should be defrayed out of capital or by revenue, went on well-defined principles. When depreciation occurred, for instance, in the works, and it became necessary to take out a 2-inch main as no longer fitted to carry gas, the cost of that would be chargeable to revenue. But if it was necessary to substitute a 3-inch main for the 2-inch main, the difference in the cost of the two would come out of capital. The question for the Committee to decide was whether the amount of capital asked for in the Bill was excessive, and also whether the standard and maximum price asked for were excessive or otherwise.

The following evidence was then called:—

Mr. *George Henderson*, examined by Mr. Michael.

I am Chairman of the Directors of the Plymouth and Stonehouse Gas Company. I assisted in the formation of the Company in 1844, and was then appointed Secretary—an office which I held until March, 1878, when I resigned, and was appointed a Director. At the time of our Company being formed, the district was supplied by the United General Gas Company, and the price charged was 9s. per 1000, while numerous consumers were paying upon the time and burner system, which amounted to a much higher rate. Concurrently with the formation of the Plymouth and Stonehouse Gas Company, a similar Company was formed in Devonport, and the Bills of both Companies came before Parliament at the same time, and were opposed by the United General Company, who gave evidence that, owing to the limited amount of consumption, the Companies would be unable to fulfil the expectations held out of supplying gas at 6s. per 1000; but we fulfilled our undertaking, and only charged that amount. We were authorized to raise a share capital of £25,000, and had borrowing powers of £8333. An active competition was carried on in 1846 and 1847, but early in 1848 the United General Company evinced a disposition to abandon the contest, and negotiations ensued, which led to the purchase of their works by the Plymouth Company. In 1854, in order to diminish the cost of production, the works at Milbay were closed, and the whole manufacture concentrated at Coxside. In 1855 we obtained an Act to raise an additional capital of £50,000, and our borrowing powers were increased to £20,000, and there was also an enlargement of our limits of supply. The dividend on the original capital authorized by the Act of 1845 was 10 per cent.; but from 1846 to 1854 the Shareholders only received about 6 per cent., the total deficiency amounting to £6350. No interest was paid to the Shareholders during the time the works were being constructed. The whole of our capital was issued by 1862, and the last instalment was paid up in 1870, in which year the gas manufactured was nearly three times the amount made in 1854. We applied for a Provisional Order under the Gas and Water Facilities Act of 1870, asking for power to raise £50,000; but we failed to obtain it. At that time we had unexpired borrowing powers to the amount of £20,000, which, under the powers of the Companies Clauses Act of 1845, has since been transferred to capital, and has not yet been all called up, but will have to be during the present year, to meet the outlays we are making. We commenced to form a reserve-fund in 1856, and in 1860 it amounted to £7500. During the coal famine it was reduced by £2000, and now stands at £6781 7s. 1d.; but we have power to raise the fund to an amount equal to 10 per cent. upon our nominal capital. We have also a contingency-fund, amounting to £3019. As our financial position has improved, we have met that by a corresponding reduction in the price of gas. Our present charge is 2s. 3d. per 1000, which is a reduction of 1d. from the previous year. We have also made similar reductions in the price charged for the public lights, which we supply by contract. The contracts are for three years, but it is only right I should say that during the existence of those contracts the Company voluntarily reduced the price to the town authorities to the extent of £1300. The price has been reduced from £4 to £2 14s. per lamp. The annual production of gas has uniformly increased, and during the last year the increase was about 10 per cent. New streets are being formed, and numerous houses erected, and it is absolutely necessary that we should spend more capital, to meet the requirements of the town. We have about 8000 consumers, and we have not had a complaint from one in reference to our application for this Bill. It is fallacious to say—as alleged by the petitioners—that we have taken £52,000 out of revenue, and charged it to capital. In 1847 we spent for depreciation of plant £302, and we have gone on year by year expending sums of money which were necessary in order to meet the depreciation in works. If instead of taking it out of revenue we had taken it out of capital, it would have amounted to £70,967 17s. 6d., and would have involved a permanent charge upon the undertaking of £4811 per annum in perpetuity. We have nothing remaining in the works which was there when they were first erected. If there has been one point more than another which has received the attention of the Directors, it has been to avoid unnecessary outlay of capital. I have prepared a statement of capital, income, and expenditure, and the profit per ton of coal carbonized, compared with six Metropolitan Companies, and I find that in the mean of the six Companies the amount reserved for profit was 13s. 6¼d., whereas ours was only 6s. 10½d. In 1854 the quantity of gas produced per £1000 of capital was 2 million cubic feet, but we are now producing something like 4 million feet for every £1000 of capital embarked. I do not know of any company whose capital is so low in proportion to the production of gas, and that eventuates in a very much smaller amount of profit being required to pay our dividends. We commenced paying income-tax from the formation of the Company, although we were only paying 6 per cent. dividends, while other companies have paid their dividends free from income-tax. I consider the standard price of 2s. 9d. asked for in the Bill to be extremely low. Our charge at the present time is 2s. 3d. We shall be obliged to expend at once from £36,000 to £40,000, which will require some increased amount of profit in order to pay dividends. The present cost of our coals, including freight and cartage, is 14s. 9d.; in 1874 it was £1 6s. 1d., and the average for the past 10 years has been 19s. 0·34d. The quality of gas prescribed by our former Act was 10 candles, but we have supplied about 13 candles on the average. By the present Bill we shall be obliged to supply 14 candles, which will involve our going from 15 to 15½ candles at the works, which means increased cost to us, and involves the use of an increased percentage of cannel. The price per ton I have given means the price of coal and cannel combined, added to the freight.

Cross-examined by Mr. Cripps: When our Bill was deposited we did not incorporate the auction clauses, but we subsequently found we were obliged to do so. The standard price in all Bills has been considerably higher than ours. We are an exception to any other Company, because we are supplying gas at a price that no other Company are doing. The sliding scale as we have introduced it only works one way, and is founded on the principle adopted in the Newcastle and Gateshead case. I believe that was a matter agreed upon between the parties, and if we succeed it will be the first case in which such a sliding scale was inserted when the matter was contested. Previous to 1844 the town was supplied by a foreign company, the price was excessive, and the quality of the gas bad, and therefore it was thought desirable to establish a consumers company, and since then we have always adopted the principle of giving the consumer the benefit of the reduction of price when our circumstances allowed us to do so.

Mr. Cripps: I find that while you were in a state of competition you were dividing 6 per cent., but in 1855 you arrived at paying the maximum dividend to your Shareholders, and since that time those dividends have been paid in full?

Witness: They have; and the price has been continually reduced, down to 2s. 3d.

But you were bound to reduce the price. As soon as you divide your maximum dividend, then any surplus goes to the consumer?—Yes, after our reserve-fund is full; but it never has been full.

The Chairman: What is the amount annually which might be added to the reserve-fund?

Mr. Michael: Any amount. The whole amount might be added in any one year.

Mr. Cripps: It is any amount, so long as the whole amount does not exceed 10 per cent. of the capital?

Witness: We are entitled to carry to reserve £9000. Our reserve-fund at

the end of the year 1860 stood at £7500, and since that period we have been giving the consumers the benefit of the reduction in price.

Cross-examination continued: It is ten years since the present remuneration was granted to the Directors, and since then there has been no increase. Labour is about the same as it was three or four years ago, and salaries also. The average price of coal for the year ending March 3, 1870, was 15s. 11·89d.; 1871, 15s. 5d.; 1872, 16s. 9·50d.; in 1873, 23s. 5d.; in 1874, 26s. 1d.; in 1875, 23s. 10·50d.; in 1876, 19s. 4d.; in 1877, 18s. 1d.; in 1878, 16s. 6d.; and in 1879, 14s. 9·53d. There is a considerable variation in the price of our residual products; during the coal famine we were not doing so well with them. The rate of freight is an important item with reference to the cost of coals at Plymouth, and it varies considerably. The transfer of the £10,000 from loan to share capital was made under the powers of the General Act.

Mr. CRIPPS: The result was that you obtained 7½ per cent., whereas you could have borrowed at 5 per cent., and the difference of 2½ per cent. would have gone to the consumers instead of to the Shareholders?

Witness: Yes; that is applicable to all companies; but we reduced the price to the consumers at the same time.

Cross-examination continued: Under the Act of Parliament we are bound to file our accounts annually with the Clerk of the Peace for the county. The item of "Income-tax" does not appear upon the face of those accounts, but is a credit under the head of "Interest." All the items upon the receipt side of the accounts are amounts which we have received.

Mr. CRIPPS: When I come to how that sum has been spent, on the other side I find "Wear and tear of plant" about £3000?

Witness: Yes; that is so.

But the wear and tear of plant is not the money actually paid, but an estimate of the loss your plant has incurred by wear and tear?—Yes.

How can it be that on one side you have money actually received, and when you have to show how it is got rid of you show £3000 for a depreciation?—That amount is charged against plant; it has gone to the credit of our concern.

You have received £36,933—you have got that as much as if it was put into your purse—and I want to know what is done with it?—It is carried to an account in our books, under the head of "Depreciation and renewal of plant," and is expended from time to time.

Your accounts are made out yearly, and I see all through, "Dividends paid in January;" why do you not put, "Dividends paid in July"?—Simply because we cannot declare our annual dividend until the yearly meeting takes place. Our accounts are made up to the close of the financial year, which is March 31, and the annual meeting is not held till June. At those meetings we take authority to pay half-yearly dividends on January 1, in anticipation of the dividend to be declared at the annual meeting, when those accounts are brought up, and out of the balance the dividend for the remaining half year is declared.

I see that each of your annual accounts ends with a balance?—That is for some few years past; not always.

Having left yourself with a balance in the year 1874, say, when I come to 1875, I see that balance is not taken into consideration at all, but some totally different sum put as the balance brought forward?—That is less the half year's dividend.

I have here, "Balance carried forward, £1842," while the dividend paid in January was £3125, therefore that balance would not have been nearly sufficient?—That statement of account is not correct, because we had to take £1500 from our reserve-fund that year to pay our dividends. I had forgotten that for the moment, but the report sets it all out.

Mr. CRIPPS said he would not press the matter further, because, under the altered circumstances of the Bill, it was a question of small importance.

Re-examined by Mr. MICHAEL: We have a separate account of the depreciation-fund in our books, but it is not filed because it is not necessary. The words are, "an abstract of accounts," and two lines will satisfy that. Sheffield, for instance, which is a large undertaking, only gives two lines, credit one side and debit the other, without any details whatever.

Mr. *J. T. Browning*, examined by Mr. MICHAEL.

I was appointed Engineer and Manager of the Plymouth Gas-Works in 1856, at which time the production of gas was 80 million feet, while it is now 520 millions, and is still increasing. Since I have been there the old works have been entirely swept away, and new ones erected. We manufacture sulphate of ammonia.

Mr. MICHAEL: There is no contest about your works being good and efficient, but how much do you say is now required to be expended?

Mr. CRIPPS said he did not contest the capital, because, with the auction clauses, he thought it was immaterial.

Cross-examined by Mr. CRIPPS: I do not keep an account of the sale of residual products, because it does not come within my province.

By the CHAIRMAN: We are now working up to the full maximum of our producing power. We require new retort-houses and new condensers, and also to increase the whole of our plant, to meet the growing requirements of the population.

By the REFEREE: We make about 10,000 feet of gas per ton of coal, and sell a little under 9000 feet.

Mr. *G. W. Stevenson*, examined by Mr. MICHAEL.

I have prepared a statement, showing in detail the cost of producing gas at the present time by the Gas Company. The total quantity sold last year was 272,254,000 cubic feet. The proportion of unaccounted-for gas is 18·287 per cent., which includes that used upon the works, and also the leakage, or what has been stolen. Plymouth is a very irregular place with regard to levels, and therefore the leakage is greater than in other places which are more level. The cost of coals last year was £24,750 16s. 8d., and the residual products realized £14,763 7s., leaving the net cost £9987 9s. 8d., which worked out to 8·80d. per 1000 feet. The cost of manufacture, including wages and salaries, was 21·63d., and depreciation, 2·64d. Putting the whole of the expenses together, they come out considerably less than those of the London Companies. The capital employed works out to £250 per million feet of gas sold, which is a very large proportion of production to capital, and has not a parallel in the kingdom; £400 and even £500 is considered low. The sum of £26,000, at 7 per cent. dividend, offered at public auction, will realize the £36,000 which is required at once to be expended upon the undertaking. That £10,000 will go into the capital of the Company, bearing no dividend, and will go in reduction of the price of gas. I think the Company are very moderate in asking for a standard price of 2s. 9d. In the year 1874 the cost of coal was £33,617, and the residuals realized £16,345, leaving the net cost of the raw material £17,272, while last year the cost, after deducting residuals, was only £9987.

Mr. MICHAEL: So that, roundly, it costs twice as much in a dear year, though the residual products realized a higher price also?

Witness: In this case it is so.

The CHAIRMAN: Are you taking the whole of the coal used in the two years, or are you taking the same quantities?

Mr. MICHAEL: I am comparing the two items; if I divide it by a larger divisor it will be more in my favour. (To witness:) With respect to the sliding scale, that is altered by introducing a maximum as well as an initial standard price, so that the Company cannot, under any circumstances, charge more than the maximum?

Witness: No; they cannot charge more than 3s. 4d. per 1000 feet, and therefore their dividends must be diminished if they cannot make gas at such a price as will pay the maximum dividend. I do not, however, care to express an opinion upon that provision. The matter was arranged at Plymouth upon the basis of the Newcastle and Gateshead and South Shields Gas Bills; but, for my part, I do not see the *raison d'être* of that 3s. 4d. I think they ought to be left with a sliding scale up and a sliding scale down.

Cross-examined by Mr. CRIPPS: I think the sliding scale is a very good thing, but I cannot take to myself the credit of having introduced it. Several Bills have recently been passed without it, but companies, as a rule, elect to adopt the sliding scale. I think the auction clauses make the sliding scale fair, and *vice versâ*. I do not know of one case in which the sliding scale has been compulsorily introduced. [Witness was examined at some length with regard to the introduction of the sliding scale and the auction clauses in the case of the Metropolitan Gas Companies.]

Mr. CRIPPS: Supposing the Company to be actually charging 2s. 3d., we will say, and you put their standard price at 2s. 9d., that would enable them at once to divide 11½ per cent. instead of 10, would it not?

Witness: Yes, if the price of coal and everything remained the same; but we have the evidence of Mr. Henderson, that the average cost of coal in the last ten years has been considerably greater than it is now—so much greater as to make a difference of 6d. per 1000 feet in the price of gas.

In all cases where capital is increased you look to it to produce as much as the old capital?—Yes, eventually, and more, because money is now more economically and advantageously laid out than it was years ago. But, in the case of the Plymouth Company, their works are now being utilized up to the very hilt, and they are really carrying on their business under very great difficulties; they require a considerable expenditure of money in order to enable them to carry on their present trade.

They have expended out of revenue year by year a sum which amounts altogether to £50,000, and therefore they have not been stinting their expenditure upon works for some time past?—Not in maintaining them; but they have been stinting the expenditure upon capital account very much, I think.

If there had not been so large a sum expended upon the renewal of plant, and things of that kind, it would have gone in the reduction of price to the consumers?—No; not eventually, because the Company would have had to raise capital.

They might have had to raise capital; but, instead of doing that, they spent money which was the money of the consumers and not of the shareholders?—No, it was not. They did not spend enough year by year on renewals; and as renewals have to be made sometimes in bulk and not in detail, they very wisely put by a small sum, which should have been really a suspense account, which could be applied to the construction of gasholders.

If they had not spent it in that way, it must otherwise have gone in reducing the price of gas to the consumers?—No. They would have had to call up capital year by year to such an amount that the present increase of dividend required would have been nearly £5000 a year.

That would simply have been a question between the immediate consumer and the consumer in some future year?—That is all it would come to; the consumers of the present day would be paying £5000 more than they are doing.

By the COMMITTEE: The life of the different parts of gas-works is well known. That of a gasholder, for instance, is about 20 years; a service-pipe, about ten years; a meter, about ten years; a purifier, from 15 to 20 years. All these things die, and have to be renewed, and if they are renewed out of capital—as is the practice of many London and provincial companies—the capital becomes enormously swollen, and the consumers are paying dividends upon that which is absolutely dead. In this Company it is taken out of a depreciation or renewal fund.

Mr. CRIPPS: In this case, it is not entirely what we should call a depreciation-fund. I believe they have bought land for works out of that fund, have they not?

Witness: To some extent, I believe, they have.

Mr. MICHAEL: No; they have not.

Witness: I thought they had; and, if so, they would have done wisely.

Re-examined by Mr. MICHAEL: In my investigations of the accounts of the Company, I have not found anything in which the consumer of gas has been injured by the expenditure of revenue for capital purposes, because the working expenses in the revenue account, added to the depreciation and contingent funds, amount to less than is ordinarily expended by companies upon repairs and renewals.

By the REFEREE: The Company have other sources of income besides the gas-rental; there are meter-rents, and so on, which I dare say represent 3d. per 1000 feet. There is a sum of £2077 for meter-rental, which is a source of income quite incidental to the business of the Company.

The REFEREE: These meter-rents will be applicable in the future just as much as in the present. You must, therefore, take that item into account in fixing your standard price, must you not?

Witness: It is not usually taken into account. Some companies lend meters without making any charge.

By the COMMITTEE: The profit from meter-rents is nearly equal to 2d. per 1000 feet. The Shareholders at present get the benefit of that, but the Company might adopt the plan of supplying meters without any charge, and then that source of revenue would fail.

By the REFEREE: I could give numerous instances of Bills which have been passed where the standard price has been made considerably higher than the selling price.

Mr. *Alfred Penny*, examined by Mr. MICHAEL.

I have made my own calculation of what I consider it will be necessary to spend upon extensions in these works, and I find it comes to approaching £40,000. I have assumed that, if £30,000 of capital is sold, it will produce £40,000; and I have taken the sum necessary to pay a dividend on that capital at £2000, which works out to 1·85d. per 1000 feet. My calculations are based upon the assumption that the price of materials remains the same. We all know that at the present moment coal and iron, and other things which enter into the production of gas, are abnormally cheap, but I believe that the next change will be an upward one. I think it right, in fixing the standard price, that some margin should be given to a company; the Chairmen of Committees in both Houses have recognized that fact, and have given a margin in most cases. In the South Metropolitan case there was a margin of 6d., but a much larger difference has been inserted in some other Bills. With regard to the alleged wrongful expenditure of £50,000, I distinctly say that no wrong has been done, because it was necessary to spend money from time to time to keep up the works without depreciation. The first thing which struck me, in examining the Company's accounts, was the smallness of the sum charged for repair and maintenance. I made some inquiries about the allegation in the petition, where £52,000 is said to have been spent out of revenue for capital purposes. I then took the Company's accounts, and ascertained what amount per 1000 feet had been actually spent for maintenance and repairs, which I found very small; then I took all the sums which made the £52,000, and added them together, and I found that those two sums put together were still less than the average spent by all the Metropolitan Companies for the same purpose. The sum spent by the Metropolitan Companies during the

last ten years for repairs and maintenance is 4·65d. per 1000 feet of gas sold, while the expenditure of this Company amounted to 4d. and a small decimal. I may explain here that this Company have had a method of their own in keeping their accounts. Instead of charging every year the full sum for maintenance and repair and renewal, they charge for the ordinary repairs just what is necessary, and they put aside a sum which they draw upon year by year to execute those renewals which are from time to time required to be done; so that they have really, during this large number of years, spent every shilling of that £52,000 in upholding the *corpus* of their works. They have not done as some companies do—that is, if they build a new gasholder, simply sell the old materials, and credit their capital with that, and then charge capital with the new one. I consider that system is not right, but that the works ought to be upheld out of revenue, as this Company have done.

Mr. MICHAEL: If it had been done as my learned friend suggested—I will suppose an expenditure of £1000 taken from revenue and spent in the production of gas—you must have taken £1000, and put it into capital, upon which a dividend of 10 or 7½ per cent. would be charged?

Witness: Yes, that would be the first result of it; but I say, having regard to the fact that the works must be kept up, if they had not spent the money which they have done out of this fund, they must have raised fresh capital, upon which a dividend would have to be paid, and which would produce the result you state.

That would be a permanent burden of £4800 a year, and an accruing sum of £50,000 over the whole period?—Yes; but it would have been wrong to raise the money for capital purposes, because it had been raised once, and they were paying dividends upon it.

You have gone into the net price of coal, after deducting residual products. Does it appear that, when coal is dear, although the residual products may fetch a larger amount, yet there is an increased sum cast upon the Company?—If it were not so, there would have been no reason for the special legislation of 1873, in order to meet that difficulty. It cannot be contended that the increased price of residual products will countervail the increased price of coal.

Cross-examined by Mr. CRIPPS: I do not entirely agree with Mr. Stevenson, with reference to the £50,000, because I say that that fund ought to have been maintained at such a point that the renewals could always be made from it, without having recourse to capital. I went to Plymouth about three weeks ago to examine the works. I saw the Company's accounts, but did not go into all the particulars; I only dealt with the general results. I did not ask the question about the workmen's wages, but I should think they were higher than they were 10 or 12 years ago; they are higher everywhere else.

Mr. CRIPPS: I think you will agree with me that, under the auction clauses, the new capital will be raised, not higher, but possibly lower, than 5 per cent?

Witness: I have taken it at a little over 5 per cent. I say a sale of £30,000 of shares will produce £40,000 in money.

The capital with which they are working now, and which they have been working with, is capital upon which they have been entitled to a dividend of 7½ or 10 per cent., and, therefore, the increased capital, whether divided among the Shareholders or not, will be raised cheaper than previously?—Yes.

Then, if the Company have been able to pay 10 and 7½ per cent. in the past, *à fortiori* they will be able to pay it when they have more capital at a cheaper rate?—Yes; when it becomes profitable.

When you say, "when it becomes profitable," of course it will be prudently spent from time to time, as required?—The Company cannot regulate their expenditure year by year, as they could wish. If they want a gasholder, they must make it all at once, but they may not want another for ten years. If they want a retort-house, they may only require 10 per cent. of it to begin with, but they must build the whole house at once.

Supposing it were the case that, at the first going off, the expenditure of this new capital was a little worse for the Shareholders, after a year or two it would be a great deal better for them, would it not?—Not after the first two years, but after a certain period.

With regard to the proposed illuminating power of 16 candles, the old Acts had 10 or 12 candles, or certainly not higher than 14, but has not the improvement of the burners, quite irrespective of any improvement in the gas, raised the illuminating power, which would have been 14 candles, to 16?—The old standard was 12 candles, and when a burner was discovered which would give a greater illuminating power, Parliament raised the standard to 14 candles. I do not think that the improvement of the burner would give a difference of 2 candles between 12 and 14. I take it at about 1½ candle, and for this reason, that when it is necessary to produce a standard of 14 candles, a small quantity of cannel is required. I should think, for 16-candle gas, from 7 to 8 per cent. would be required.

Re-examined by Mr. POPE: If the consumers chose to buy their own meters, the Company would receive no rent for them, and that source of income would therefore cease. In fixing a standard price, I think it would be only fair to take into account that which is necessarily an uncertain source of income, independent of price. The standard of 2s. 6d. is based upon the present cost of raw materials, and I, therefore, think a margin should be allowed.

By the COMMITTEE: I have included the cost of repairing the meters, and the renewals also, in my statement of working expenses.

Why do you take that in, when you leave out the meter-rents?—There is a profit of 1½d. per 1000 feet upon the supply of meters by the Company, and it is not at all an improbable thing that the consumers, now the question has been once ventilated, might say, "We will provide our own meters, and save the difference, as the Company get so much profit by it."

By the REFEREE: I never saw a clause similar to the one introduced into the present Bill with reference to the sliding scale, and I do not uphold it. The Company apparently wish to guard themselves from any diminution in the dividend so long as they charge no greater sum than 3s. 4d. per 1000 feet for gas; so that, for a certain period, the sliding scale would slide one way only.

Mr. POPE said that was the case for the promoters.

FRIDAY, MAY 16.

The CHAIRMAN said he should like to have some information as to the actual amount received for rent of meters during the last five years.

Mr. CRIPPS said that in 1874 the meter-rental was £1863, and in the same year the cost of meters was £513; in 1875, meter-rental £1913, and cost of meters £427; in 1876, meter-rental £1955, and cost of meters £448; in 1877, meter-rental £2007, and cost of meters £441; and in 1878, meter-rental £2077, and cost of meters £585.

Mr. *R. P. Spice*, examined by Mr. CRIPPS.

I have examined the gas-works, and also the district lighted by the Company, and have considered the case on behalf of the Company, and also on behalf of the gas consumers as represented by the Corporation. Plymouth is a place which affords every facility for carrying on the manufacture of gas very cheaply, with regard to the delivery of coals, and so on. The Engineer informed me that the Company used 5 per cent. of cannel coal, which would give a light equal to 16 candles at the burner, if properly made. By modern appliances, we now make 15-candle gas by using 1 per cent. of cannel coal added to Newcastle coal.

Mr. CRIPPS: Of course I assume that, with proper working, as an intelligent engineer would work, it would produce that?

Witness: It is a system which is rapidly coming into use. It is not entitled to be called general, but it is now practically available at any works in the kingdom of sufficient size to warrant the introduction of a moderate amount of machinery. It has long been the object of gas companies to introduce a less amount of hand labour, and this was sought to be effected by the "steam stoker," as it was called, which proved a failure after a great deal of money had been wasted, and has been entirely given up. The next step in the history of gas-making has been the introduction of the hydraulic stoker, which, I think, will come to the same unfortunate end. Then came a new system—called West's system—which I strongly advocate, from an earnest conviction that it is exceedingly valuable to gas companies, and, therefore, to the consumers also. It is a combination of hand with machine labour, by which the character of the labour is very materially ameliorated. Men cease to be slaves, and cease to use muscle and fibre to that exhausting extent which is involved in perpetually lifting the charges of coal from the floor into the retorts by means of a scoop. West's process is one of receiving coal from the store into a receptacle upon a level with or below the floor, and breaking it in that pit by a coal breaker, which necessitates a very small amount of mechanical power. When broken, it is lifted by an endless chain of buckets into an overhead hopper, and from thence it is allowed, by means of a slide, to fall into a travelling hopper, which leads it to the front of the retorts, where there is a little waggon, which holds a given quantity as accurately as if it were weighed into the waggon, and which runs upon four little wheels into the retort. When it arrives at the end of its short journey—nine feet—a handle, which is given a half turn, throws open the bottom of the waggon, and there is left a level stratum of coal upon the bottom of the retort, about four inches thick. The consequence is, that the gas is drawn out of the coal by distillation in two-thirds of the time in which coal is ordinarily left in the retort for the purpose. Four-hour charges are adopted under that system, instead of six, so that two-thirds the number of retorts are sufficient, and two-thirds only of the furnaces require to be fed by coke, and the labour is therefore reduced in cost more than one-half. The general effect is, that gas costs 6d. per 1000, in round numbers, less than it could be made upon the old scoop system, and the quality of the gas is also improved. I have introduced the system into three or four gas-works, and it is now being introduced at Manchester. I wish the Committee t understand why the illuminating power had been increased withou putting in any cannel at all. The increase is something like a candle and a half; and the reason is that, under the old process, the coal being distilled in a mass, and the heat having to get to the centre of that mass, the outside is overbaked or overcooked before the inside gets the heat to drive the gas out of it. The consequence is, that the proportion of gas made is very much poorer than when it is driven off quickly.

Do I understand you to say that, with the same coal which is used, and with the 5 per cent. of cannel which they use at Plymouth, they could give 16-candle gas at the same cost?—They could give it at a less cost than they now supply 14-candle gas at. When the new burner was introduced the standard should have been increased to 16 candles, to maintain the same consistent level, but it was not done. The standard of the Metropolitan Companies has been increased to 16 candles.

Mr. POPE: Out of 32 Gas Acts passed last year, 27 were allowed 14-candle gas.

Witness: That may be so. I am not arguing, as Mr. Pope would suggest, in favour of a universal law of 16 candles; but in all undertakings above a certain size—such a concern as this—16 candles ought to be the rule where machinery is employed.

Examination resumed: I have no doubt the gas made at Plymouth ranges from 14 to 16 candles. The capital of the Company is exceptionally small; there is no other such case in existence. Where there is a very small capital, it follows, as a self-evident proposition, that a much smaller price per 1000 feet is required to produce a given dividend. Taking the gas supply at Plymouth, about 6d. per 1000 would be required to pay the highest dividend they are entitled to. I take it upon a larger amount than was stated yesterday to have been the fact—viz., that 274 millions, or thereabouts, are sold instead of about 284 millions which ought to be sold. I took the quantity made, which I was informed was 300 millions, and allowed 10 per cent. for leakage and unaccounted-for gas, which is quite enough, and ought not to be more. I suppose the mains and services want overhauling. The actual profit realized upon gas and other matters which come in the way of receipts and profits was 8·70d. per 1000, and the profit upon gas-making was 6·69d.

Mr. CRIPPS: In other words, there was a larger actual profit, taking all the circumstances into consideration, realized per 1000 feet than would have been sufficient to pay the dividend which the Company are authorized to pay by law?

Witness: About 2½d. in excess of what would have been requisite to pay the dividend, in round figures.

What would be the actual net profit realized by the year's working, assuming the dividend is paid at 10 per cent. upon £25,000 and 7½ per cent. upon the balance?—The actual profit realized was £10,370 1s. 11d.

How much of that was required to pay the dividend?—Exactly £7000; 10 per cent. upon £25,000, 7½ per cent. upon £50,000, and 7½ per cent. upon £10,000, which make respectively £2500, £3750, and £750. The result would be that the profit actually realized would have been £3000 more than the amount required to pay the dividend. The profit from gas-making proper was £7923.

Mr. POPE: That works out pretty much as we put it.

Mr. CRIPPS: You have spoken of the different improvements in the manufacture. I think we may say that a more economical mode of making gas has been going on from year to year?

Witness: Yes. During the last few months gas companies have been stimulated to that end more than ever by what I may call the "scare" with regard to the electric light; and it is to the interest of gas companies to accept the warning, and brush themselves up as much as they can to effect the greatest possible improvements.

Then the working of the Company last year is no sufficient test of what they might get by more efficient working in future years, taking into account all the recent improvements and discoveries?—Certainly not. Several hundred feet more than was effected last year ought to be obtained, and the wages item might be materially reduced.

Mr. POPE: Except that we have not adopted West's system?

Witness: There is no reason why you should not.

Examination resumed: The possible addition to profits, according to my calculation, by the adoption of modern appliances, amounts to £5690.

The CHAIRMAN: What do you base your calculations upon?

Witness: Upon the actual working of West's system; the saving upon the item of labour itself exceeds 1½d. per 1000 feet.

Mr. CRIPPS: Taking the margin of profit which was left to them upon the working of the last year, which we have taken at £3000, and adding to it what they ought to do by improved appliances, they would have a margin of £9000, would they not?

Witness: It works out to £9084. That is based upon the results of last year, and those results were achieved at 2s. 4d., which would warrant a standard price of 2s. With the adoption of West's system 1s. 10d. per 1000 feet would pay a maximum dividend, and leave a surplus.

The CHAIRMAN: All those calculations are based upon the adoption of West's system?

Witness: All those as to the extra £5000 are.

Mr. POPE: They are based on the working of last year, *plus* what Mr. Spice suggests would be the saving by the adoption of this improved system.

Mr. CRIPPS (to witness): But you, as a gas engineer, can say there is no reason why those improvements should not be adopted?

Witness: They must be adopted. It is to the interest of every company to adopt all labour-saving appliances; and if they do not adopt this system it would be because there is something better worth having which will make the gas cheaper still.

Examination continued: The profits which have been expended upon the works could not by any possibility have been divided among the Shareholders, because they had been receiving their full amount of dividends, and therefore they must have gone in further reducing the price of gas. The works are now in a very efficient state, and for that reason there is no depreciation to provide for, for some time to come. I think that from 1d. to 1½d. would be the amount to lay aside for any depreciation which would be likely to arise during twenty years.

Mr. CRIPPS: You know the extraordinary sort of sliding scale inserted in this Bill?

Mr. POPE (interposing) said he should not ask the Committee to sanction it in that form, but in the ordinary way, according to the rules of the House.

Examination resumed: Assuming the new capital to be granted, with the auction clauses, I should say the Company would require about £10,000 a year for the next three years.

Mr. CRIPPS: Assuming that to be so, would that involve, even temporarily, any considerable loss in the dividend which they might be able to pay?

Witness: Not a penny; there would be no interregnum at all about the dividend. I entirely disagree with Mr. Stevenson as to any addition to price to meet the loss which he anticipates, owing to the importation of fresh capital, before the business could be sufficiently remunerative to pay for it. Mr. Browning estimates an expenditure of further capital of £36,000, of which £26,000 only would be bearing dividend at 7 per cent., amounting to £1820. Nearly three years will elapse before all that £36,000 can be expended, and during that time the rental of the Company will have materially increased. At 6 per cent. per annum, dating from March, 1878—the year which has been under review for the purpose of this inquiry—and going three years forward, we have four years increase, equal to 24 per cent.; but if we assume, which is very unlikely, that in two years from March 31 last this £36,000 may be expended, we still have 18 per cent. increase, which, on the quantity sold last year, is 49 million feet, and at 8d. per 1000 feet profit—which is less than was realized last year—the result would be an additional profit available for dividend upon the further dividend-bearing capital of £26,000, to the extent of £2966 13s. 4d.

By the COMMITTEE: That entirely disposes of Mr. Stevenson's fallacy, that to pay dividend on the further capital of £26,000, 1·60d. per 1000 feet must be added; and as to the claim of 2·64d. per 1000 feet for depreciation, it is a mere pretence, seeing that the works are, as Mr. Stevenson says, "entirely new." I consider that ½d. per 1000 feet would be ample to lay by.

Mr. CRIPPS: When once the gas-works are established, and the whole concern is working, of course every increase annually in the make of gas has a very large effect upon the capital—more than it would at the outset?

Witness: It sometimes happens that there is a large expenditure at the outset; as, for example, if the works have to be abandoned after a very large outlay; but, in the ordinary way, as capital goes there would be a demand for it. If a new gasholder is required, the outlay is great in proportion to the size of the concern, and there may be a little difficulty here and there, but scarcely ever. If money is judiciously laid out, there never need be any alteration in the rate of dividend paid upon the old capital, or any deficiency upon the new, and it will not be so here.

Cross-examined by Mr. POPE: West's improvements have been adopted and are in successful operation at Richmond, where they have dispensed with the use of cannel altogether, and also at Ipswich; and Manchester has now ordered them. I do not know whether the system is at work anywhere else.

Mr. POPE: I find that "R. P. Spice, Esq.," is the Engineer to the Company.

Witness: You would not have seen his name to it unless it had been a good thing.

It will find its own way in the course of time?—It will, if people have money to use it. Mr. Livesey the other day gave his emphatic approval of it. I am endeavouring to advocate it wherever I can, and am doing so here.

The charging of a hopper with an endless system of little buckets I have seen in Lancashire?—It ends in a saving of 6d. per 1000 feet.

Can you tell me of any one case in which a company has asked Parliament for so low a standard price as 2s. 9d.?—I do not know that I can refer you to one; it would be very absurd for any company to ask for less than would pay their dividend.

Can you tell me any instance in which more than 14 candles has been enforced—I do not say given?—I do not suppose there is one.

Then what you have come here to say is that Plymouth ought to have the lowest standard price and the highest illuminating power of any gas company in England?—No; I do not say that at all. If you have Mr. Stevenson's list before you, it will be seen there are some 17.

Mr. POPE: There is Manchester, which is a Corporation?

The REFEREE: It is so in the cannel district.

Witness: I would not quote Manchester against Plymouth, but I would ask that Plymouth should be put on the same level as London.

Mr. POPE: Would you give us the same price as London, then?

Witness: No, because London has three times the capital per ton of coal carbonized that Plymouth has.

Then, according to your principle, the worse the management of the company—that is to say, the larger the amount of capital to the production of gas—the higher the price the consumers should pay, and the better the management of the company, the worse for the shareholders?—That is not correct. It is not worse management which has resulted in London having three times the capital per ton of coal carbonized that Plymouth has. The London Companies—and most of the companies in the kingdom—have been founded upon the principle of having sufficient capital to effect the object of manufacturing all the gas which is required. Instead of subscribing all the capital at Plymouth, it has come out of the pockets of the consumer to such an extent that one-third only of the capital nominally requisite—apart from that which was necessary to start with—has been employed. The gas should have been supplied and the works erected at the cost of the Shareholders by subscribing the capital, and upon that capital the consumers would have paid a price which would have yielded a dividend. In a concern of this kind, if the capital is equalized with the production, the whole of it is made profitable. If the £30,000 is spent in three years—and that is a great deal more than has been done before—there would be no disturbance in the price of gas. The increased business will pay for the importation of capital, and leave a margin of £1100, without any increase in the price of gas.

Re-examined by Mr. CRIPPS: Whether a company can charge one price or another, and pay their dividends, depends mainly upon the amount of the capital. The London Companies had spent a large sum in competition before the present system of districting was introduced, and that amount became a charge for ever upon their business; but, notwithstanding those large accretions of capital, prices have gradually gone down, and there has been no increase of price in London to pay for the increase of capital.

By the CHAIRMAN: Plymouth is exceptionally situated for producing cheap gas, because they can get coals easily into their works, and I suppose labour is cheaper there than it is in London. The cost of the gas production is not exceptionally low—it is 1s. 8d.—but the remarkable feature is the small amount of profit which is required to pay dividend.

By the REFEREE: The amount necessary to pay the dividend is not more than half what is usually required for the purpose.

Mr. POPE (through the Committee): I will ask Mr. Spice if he agrees with what he said in 1877 upon the question of illuminating power. He then stated his view as to the reason for fixing upon 14-candle gas, and what would be the result if the standard were raised, as follows:—"The 14 candles was established some years ago by Parliament as the common amount of illuminating power because the Newcastle coals which were available in such works naturally gave that amount of illuminating power, and anything beyond that is not to be manufactured without the aid of cannel, or something of that kind, which adds to the cost something like 3d., 4d., 5d., or 6d. It depends upon where the gas-works may be; and in this instance"—that was the Londonderry case—"it is equivalent to a reduction of 6d. per 1000 feet upon the amount charged, and that is an item to consider in fixing the standard price, and I have considered that." I should therefore like to know what is the difference between 14 and 16 candle gas at Plymouth?

Witness: Apart from the improved system of working, it would be represented by 2d. At Londonderry it would require a larger amount.

Therefore, when you were advocating 16-candle gas without the 2d. or 3d., or whatever may be a fair sum to be taken, you were advocating it in connection with these improved West's appliances?—You might sell 16-candle gas at Plymouth at 2s. 3d., and have a reserve-fund.

The CHAIRMAN: We cannot go into that.

By the COMMITTEE: The Company gave me every facility for looking over the works, and Mr. Browning very kindly answered the questions I put to him.

Mr. CRIPPS, in addressing the Committee on behalf of the Corporation, said he had another engineer in attendance to give evidence against the Bill, but he was quite content with the evidence of Mr. Spice, because a great deal had happened during the progress of the case which relieved him considerably in the remarks he had to make. With regard to the large amount of money which the promoters sought to be allowed to raise, it might be pointed out that in the Bill as originally deposited they sought to raise their capital at 7½ per cent., and, had that remained, it would have been a direct incentive to extravagance, because every hundred pounds raised under this Act, and saleable at a price which would command 5 per cent., would be so much in the pockets of the Shareholders, instead of being applied to a reduction in the price of gas; and that was a very important matter. According to the accounts of the Company, it was evident that they did not require the sum asked for; and, after due consideration, they had thought it advisable to put in the auction clauses. With the adoption of those clauses, however, it was really an unimportant matter what amount of capital they had power to raise, because if they issued more than they required the Shareholders would not be benefited, and it would only tend to diminish the profits. Another matter which would have been of vital importance was the maximum price the Company should be entitled to charge; but the timely adoption by the promoters of the parliamentary sliding scale did away with any reasonable fear that the consumers would be charged too high a rate for the gas. He was glad, from what had taken place before the Committee, that the promoters had become convinced of the impossibility of maintaining the one-sided sliding scale which they had imported into the Bill, and which would always have acted in favour of the Company and against the consumers. It was so preposterous that neither of the Engineers called for the promoters could support it. The only other question was the standard price, and there was considerable difference of opinion on that point, the Company desiring to have it fixed as high as possible, while the consumers desired to have it as low as possible. The Committee would have to award such a price as they believed would enable the Company, working with every desire to do their best, to divide the amount they ought to have on their capital. It was never intended that a Company, while dividing their full dividend, and charging the consumer 2s. 3d. per 1000, because they wanted more capital, should take advantage of the circumstance, and get the standard price fixed at such a figure as would enable them to divide 11½ per cent. instead of 10 per cent. At present they were charging the consumers 2s. 3d., and if the price was made 2s. 9d., then by going on exactly as they were doing, without any extra economy or improved method of manufacture, the promoters would be enabled to return to Plymouth with the power of dividing £11 10s. per cent., instead of £10; and £8 10s. instead of £7, to which they were now restricted. That extra percentage would be money absolutely taken out of the consumers pocket.

The CHAIRMAN: Is the reserve-fund applicable in its entirety to make up the dividend?

Mr. CRIPPS said it was applicable to make up the loss arising from circumstances for which the Company could not be held responsible. The natural increase in the consumption of gas would compensate for any loss the Company might suffer from their new capital. But, even supposing that any loss did happen, then that was a case in which the reserve-fund should apply. He admitted that the Company had been very well managed, but they should not take too much credit for that, for it must be remembered they had got every shilling out of the consumer to which they were legally entitled. They obtained the works of the old Company at a very low sum, and they employed the capital which might have gone to the reduction of gas in the improvement of the works. From one of the tables which had been put in it appeared that the Company began by charging 6s., and dividing only 6 per cent., and that went on for several years. That was in the early days of gas-making, and before improvements were introduced. They went on with 6 per cent., with an almost continuous reduction in price, except in 1854 and 1372, in which latter year it was advanced from 2s. 6d. to 3s. The Company's own figures showed—with the exception of those years—that what the Company had been charging in any one year as the standard must not be taken as the future standard price. It had been shown that the standard price of the future could be reduced down gradually until it reached the amount charged last year, which was 2s. 3d. per 1000. Why should it be thought that the experience of last year would be different to other years? The

price of coal might rise or fall. In 1873, 1874, and 1875 the price was exceptionally high, reaching to £1 6s. per ton; but that was during the coal famine. In 1872 the price was advanced to 3s., while in 1876 it was reduced to 2s. 6d. That was the whole effect.

Mr. POPE said it was not, because they had to go to the reserve-fund.

Mr. CRIPPS: But they have been able to fill it up again.

Mr. POPE: It has not been added to. The interest on the amount has been accumulating.

Mr. CRIPPS said that the contingency-fund had been formed since; and if the reserve-fund had not been filled up, the Company would not have made a contingency-fund. The table put in showed that there had been a continuous improvement in the manufacture of gas, coupled, of course, with an increase of consumption, which was a very important matter. Those two things enabled the Company for a number of years to effect a gradual diminution in price; and was not that fact instructive when the Committee were asked to consider what would be a fair price for the future? Mr. Spice thought the Company could do well with 2s., and that, if due care were observed in the management, that would ensure a good dividend. He (Mr. Cripps) did not, however, contend that the price should be fixed so low as this. He was content that it should be put at 2s. 3d., and in fixing it at that figure the Committee would be following the ordinary precedent observed in the case of the London Companies, and they would at the same time be giving the Plymouth Company the means of being even more prosperous in the future than in the past.

Mr. POPE, in replying on the whole case, said that the only question between the parties was whether the Committee would insert 2s. 9d. or 2s. 3d. as the standard price. He confessed he thought the price asked for was a most reasonable one, and had 3s. been asked for he would have argued for it with confidence. If the Company were exceptionally placed for the economical production of gas, the consumers, as a body, were exceptional to all others in the kingdom, so far as the price paid by them was concerned. With a 2s. 9d. rate, the standard price of the Plymouth Company would still be the lowest in the kingdom. He struck out the maximum price of 3s. 4d., as that rate was not consistent with the sliding scale; but he held that if the promoters had not put the 3s. 4d. with the sliding scale only on one side, but had inserted the standard price of 3s., very little objection would have been heard to it on the part of the Corporation. He was only driven to argue for 2s. 9d. because the Company had been foolish enough to put it in as a low standard price, hoping to compensate themselves by the maximum price of 3s. 4d. He would not, however, argue upon it, and he would therefore abandon it at once, and be content with the standard price of 2s. 9d; but in expressing his contentment with that price, he was only asking the Committee to give the Plymouth Company a lower standard than was enjoyed by any other company in the United Kingdom. Of course, if they thought that the illuminating power should be 16 candles instead of 14 candles, as in the Bill, the Committee would not make that alteration without giving the Company a proportionate increase in price, for it was an undisputed point that an increased illuminating power meant increased expenditure.

The committee-room was then cleared. On the parties being re-admitted,

The CHAIRMAN said the Committee were of opinion that the preamble of the Bill was proved, subject to a limitation of the standard price to 2s. 6d.; the illuminating power to remain at 14 candles.

The clauses of the Bill were then agreed to, with amendments, and the Chairman was directed to report the Bill to the House.

THE SELECT COMMITTEE ON LIGHTING BY ELECTRICITY.

EIGHTH DAY—FRIDAY, MAY 23.

(Members present: Dr. Lyon Playfair, in the chair; Mr. Alfred Gathorne-Hardy, Mr. Hardcastle, Mr. Mitchell-Henry, Lord Lindsay, Mr. Arthur Moore, Mr. Puleston, Mr. Spencer-Stanhope, Mr. Talbot, and Sir David Wedderburn.)

Sir *William Thomson*, LL.D., D.C.L., examined by the CHAIRMAN.

I am Professor of Natural Philosophy in the University of Glasgow, and was President of the Royal Society of Edinburgh for five years. I retired in due course at the beginning of the present session. I am also a Fellow of St. Peter's College, Cambridge. I have devoted much time not only to electricity as a science, but to the application of electricity to practical purposes. The energy which is actually used in the production of the electric arc is about 1-horse power per 2400 or even more candle power, according to the dimensions and other circumstances of the electric arc. One-horse power of energy in the combustion of gas produces about 12-candle power. I have made a number of experiments since I was asked to give evidence before this Committee. I have experimented on the electric light produced by a battery of 79 large dry Daniells cells of the same kind as those I use for my land and submarine cables, but of larger area. The average resistance per cell was about one-tenth of an Ohm. I have examined into the actual development of power in the electric arc produced by that battery, and I found the resistance in the electric arc was about five Ohms, and the electro-motive force between the two carbons was equal to about 24 Daniells, or about 27½ Volts. From those figures I find, allowing 0·73 ergtens per second as the activity of 1-horse power (according to Watts's old estimate of a horse power), that the work developed in this arc was two-tenths of a horse power developed in my electric arc. It was an exceedingly feeble electric light, however. I have not succeeded in comparing it with the greater electric lights; but I have made several measurements, with the assistance of Professor Tait, upon a much more powerful electric light produced by a Gramme machine driven by a gas-engine. Allowing the practical estimate of 1-horse power actually spent in driving the engine to produce 1200 candles, which has been realized, I estimate that one-half of the power goes to the electric arc, and one-half is lost in heating different parts of the machine. This, then, gives 2400 candles per 1-horse power. In respect to gas, I have taken 4 candles per cubic foot of gas per hour; I have also taken the heating power of gas at 12,000 centigrade units per gramme, and its specific gravity as half that of the air, and calculated accordingly. I have thus calculated the whole heat of the combustion of gas, found the amount of that per second of time, and reduced it to horse power. Thus I arrive at 1-horse power actually spent in warming the air and stirring the luminiferous ether in a gas-flame of 12-candle power. The difference between rays of heat and rays of light is only the difference between invisible radiation of heat and visible light; they are of the same character, and 1-horse power of energy applied to the production of the electric light may produce 2400-candle power; or, if used in the combustion of gas, will only produce 12-candle power. The electric light, therefore, being such an economical producer of the waves that we call luminous rays, I consider that it has a great future before it. In the immediate future I anticipate a very great extension of the practical usefulness of the electric light. In a future somewhat less near, I anticipate the use of the electric light for every case of fixed lights, whether in large rooms or in small ones, or in great public halls, or in passages and staircases leading to them, and even for fixed lights in the lobbies and staircases of private houses. I think that the use of the electric light is certainly not the dream of a *savant*, but a practical possibility in the future. The electric light has been in dreamland for 60 years; it has now come into the world of realities, and is rapidly progressing in good hands. A great deal of good work is now being carried on by practical men upon the light, and there is immense promise in that work. My reason for supposing so is that there is now a prodigiously greater economy in the transformation of mechanical force or energy into light than there formerly was. So far as I have examined the regulators in use with the electric light, I do not consider them to be in a very advanced stage. Even in the best regulator that we have seen, there is a considerable intermittence, or dancing of the electric arc. That is not at all essential, although there has been great difficulty felt in getting over it. I have great hopes that it has been overcome by Siemens's regulator, with a water pole, which, I believe, has been already mentioned by Mr. Siemens in his evidence given before this Committee. It was perfectly steady during the short time that I observed it; but you must remember that the ordinary regulators are sometimes quite steady for an hour, and then take to hissing. It will be necessary, of course, to have continual practical experience of this or of any other new regulator, before we can feel sure that it will not have some of the defects so much complained of in the old regulators. My opinion is that the electric light should be placed at a great height; practically speaking, for street illumination, the higher the better. Taking away buildings, and considering the question of illuminating a large public place, the same quantity of light in all ordinary weather will fall upon the ground, whether the light be high or low. If the light were half a mile high, there would be a loss through absorption in the air; but if the light be placed at an elevation of 60 or 80 feet, there will be but a small proportion lost by passing through the air, and, practically speaking, the same quantity will fall upon the ground at double the height. Double the height means four times the area, and one-fourth of the intensity. The true solution of the problem of distributing the electric light for illuminating large places is to put it far enough away. I think it should be put as high as 60 feet, if an iron pole or mast could be conveniently raised for a lamp-post of that height, or if it could be hung from the buildings, after the old French plan of swinging a wire rope from one side of the street to the other. This would render opal globes unnecessary; indeed, I am surprised that the idea of an opal globe, which absolutely wastes from 50 to 60 per cent. of the light, should be tolerated. If the light were placed high, it would not be necessary for the passer-by to strain his neck to look up at it; it would be his own fault if he did. He would strain the muscles of his neck before he would strain the retina of his eyes; so that I think that would be a sufficient guard to his eyes. Allowing for a slight absorption by the column of air—and this would be very slight—you would practically get all the light radiated by reflection down below. We do not complain of the sun. If we look direct at the sun, of course our eyes are dazzled; but we do our work by daylight, and we prefer the light of the sun to all other lights. We are not in the habit of gazing at the sun, but people are in the habit of looking at the electric light; but when they become more used to it they will be cured of that. I think that, in that way, the economy of the electric light might be doubled, inasmuch as, practically speaking, the low lights which have been exhibited in public places have almost always been screened, so as to waste at least half of the light; and they have been placed so low that there is much better light than is wanted, or than is convenient in one place, while in other places there is not enough light; or, if there is enough light all over the area, there is immensely too much light at the places nearest to the lamp. I may mention as a subsidiary advantage of not having opal shades, that the effect of the electric light would be much more beautiful; its effect upon gay scenes in theatres, ball-rooms, and concerts, would be much more beautiful than the dull, obscure, and characterless effect that is given by the use of globes. Diamonds, for instance, will glitter with incomparably greater brilliancy when illuminated by the naked electric light than by electric lights subjected to the influence of globes. I think ladies complexions would appear to as much better advantage. The question of the quality of the electric light, however, remains to be investigated, and a very slight correction of the extra proportion of green and blue light, which it seems to have, could be very easily applied with a comparatively small proportion of loss of the whole light; and thus the electric light could be reduced to identity in quality with daylight. Electric lighting, in regard to the purity of the atmosphere of buildings, has great advantages in not consuming oxygen, and not heating the air. Nearly all the heat of the electric arc radiates to a distance, but very little goes to heat the air. The waves, if I may be allowed to use a scientific expression, of the electric light, after they have fulfilled their purpose, become converted into sensible heat, not in the air, but on the ceilings, walls, and floors of the room, and they have the beneficial effect of very slightly heating them. On the other hand, in gas-flames a comparatively small proportion of energy takes the radiant form, and goes to generate waves, while a much larger proportion goes to heat the air in the neighbourhood of the flame. Thus there is always very hot air rising in the neighbourhood of a gas-flame. This would certainly produce a difference in the acoustic properties of buildings and halls. The heterogeneousness induced in the air by warming portions of it by the gas, and by the currents of those warm portions passing through the room, is probably the cause of the want of good acoustic quality complained of in concert-rooms when lighted by gas, as compared with their quality when concerts are given by daylight. The electric arc would leave the air, practically speaking, in quite the same condition as in daylight. We have no scientific law of the economy of the electric light in different degrees of division and concentration; but practice and theoretical guesses seem to agree in making the economy much less when we spend the same quantity of energy, for example, in ten feebler lights than when we spend it in one strong light. We do not get nearly one-tenth part of the whole light by any of the plans hitherto in use. But there is nothing in the mathematical discussion of the question that should render that reduction necessarily according to the square or the cubes; it is quite possible that a plan of using electric energy for light might be found, and may yet be found, in which ten feebler lights will give a sum of light equal to that obtainable by the same energy in one concentrated light. I think that electric lighting is almost fit now for use in the interior of houses and for domestic purposes. I believe that almost every drawing-room in London—in large houses, at all events—might now be lighted economically, and in all respects advantageously, by the electric light. I believe the Jablochkoff candle is the most advanced subdivision of the electric light which we yet have. For carrying out electric lighting on a very large scale, I believe alternating currents would be found to be inconvenient. There would be a loss in transmitting them to great distances through underground conductors. There would also be a great disturbance in the neighbourhood—violent shocks, in fact—in consequence of the alternation of intense currents, which, for example, would disturb telegraph wires in the neighbourhood of the conductors used for the electric light. I speak, however, with reserve on the subject. I think it possible that if, in other respects, the alternating current is found desirable, these objections may be overcome. With regard to ventilation in large halls or public rooms where the electric light is used, there is a particular advantage in using it as compared with gas, inasmuch as it allows the best mode of ventilation to be carried out without one hindrance which is felt against it when gas

is used. The best method of ventilation is, wherever it is at all practicable, to admit fresh air high up, and to drain out the used air through the floor. Thus, and thus only, can draughts be effectually avoided, and a gradually descending mass of fresh air given to those who use it. When there is a large amount of the fumes produced by the combustion of gas in the higher part of the room, there is a difficulty felt in carrying out that system. When the fumes of gas are carried off by gas chimneys, or by sunlights, then there is a counter-action, part of the air going out at the ceiling, and part being drained away through the floor, which is less advantageous for ventilation than a uniform system of letting the air come down gradually from above to the user of it, and letting the consumed air be gradually drawn away below their feet through the floor. I consider this a great advantage with respect to the healthiness and comfort, the freshness of feeling and enjoyment of persons in large public meetings. If we had not sources of light which were producing great heat at the same time, it would not be at all more difficult to ventilate through the floor than it is now to ventilate through the ceiling. I think great advantage would result from using shades or reflectors, or prisms, to improve the present character of the electric light. For instance, in the footlights of theatres, instead of a multitude of gas-flames, there might be, no doubt, a plan of multiplying the effect by mirrors sending the light in the proper directions; or even such dioptric apparatus as is used in light-houses might be used advantageously. Long passages, for example, may be economically lighted, instead of having two or three dozen small gas-burners, by an electric light properly placed with a dioptric arrangement, with white screens and mirrors at different places to intercept it, and send it in the required directions. I have no doubt that by such means every passage, in a most tortuous system of passages, about a theatre or public hall, might be economically lighted by the electric light, even as we have it at present, without subdivision, to which we look with great interest as adding convenience, at all events, to the electric light. I should not be prepared to say that the electric light is not economical now. I think with proper mirrors, lenses, prisms, and screens, it could at present be economically used throughout a house—not, perhaps, in bed-rooms, as small movable hand lights may be preferred there. It would be advisable, certainly, for a practical realization of the electric light in cities, to associate it with the distribution of power, because the same means that were used for giving electric light would be perfectly available for the distribution of power. For example, in the day time, you might distribute power by large engines, and you might turn your power into light at night. That might be very advantageous where there was a natural source of power such as a river or a waterfall. I look forward to the falls of Niagara being extensively used for the production of light and mechanical power over a large area of North America; in fact, the energy which is wasted in the Falls of Niagara might be advantageously conducted hundreds of miles, and make a manufacturing town. To conduct the electricity and power, supposing you had a 1000-horse power engine in a town, you would require powerful copper conductors. I have recommended a tubular form, with water flowing in the tube to keep up its conductive properties and to prevent it from fusing. The heat so carried off is waste heat in the first place. Some waste is necessary, but the proportion of waste may be made practically very small. Arrangements might even be made that the water for keeping the electric conductors cool should be used for a hot water supply for all the houses in the city. So that the electricity wasted by its being converted into heat in transmission, might be used for that thermo-dynamical, but humbler purpose of giving a constant supply of water at a high temperature; there would be no difficulty in raising it to the boiling point if desired.

The CHAIRMAN: Of course, where you have such a tremendous waste of power as at present in Niagara, one can conceive that being used for large manufacturing purposes; but would not the power that you would send from a 1000-horse power engine be more than you could use for slight things like lathes and sewing-machines, and such things?

Witness: No; there is no limit to the application of it on a great scale. It might drive turning lathes in engineers works, and do all the work that can be done by steam-engines.

The chief object of the appointment of this Committee is not to investigate the science or even the applications of electricity, but to recommend what form legislation should take with regard to this growing art of lighting by electricity. Have you thought at all upon that subject?—It seems to me that legislation, in the interests of the nation and of mankind, should remove, as far as possible, all obstacles such as those arising from vested interests, and should encourage inventors to the utmost. I have no doubt that great practical difficulties may be felt in the way of such legislation. I am quite aware of those difficulties. I say, in the abstract, that I think the efforts of this Committee should be to smooth the way for making easy, and as early as possible to the world, the realization of the vast advantages which these scientific discoveries promise.

Do you not think one mode of doing that might be to give to corporate bodies, or to municipal authorities, power to extend the use of this light as easily as possible?—Yes; provided that those bodies will really promote, and not obstruct the improvements and the changes necessary.

Following out a case of the kind that you mentioned, if you had copper tubes, such as you suggest, for carrying off the electricity produced by a 1000-horse power engine, the tube would have to be of considerable size, would it not?—It would be considerable, but not considerable to such an extent as to be very difficult of realization. It would be much less than a foot in diameter, I believe.

Would it not be practically impossible to say to all companies, that might be offering to supply the electricity, "Each of you shall be allowed to lay down what wires you like in a street?" Would they not come to be very much what gas-works in competition were—viz., intolerable to the public—if they were always pulling up the street at their own discretion?—No doubt great inconvenience would arise from giving any general liberty to tear up the streets. But if, on the other hand, you gave it to any one electric lighting company, it would be giving that company a practical monopoly of the district. So that I cannot see any other way by which you can prevent a monopoly of the district than by keeping the power of permission in the hands of municipal authorities.

At the same time, a great many of the applications of electric lighting just now are individual, and not central; that is to say, the application is made in a hall, or in a place where the light is used, and not in a place of central distribution, as in the case of gas?—No; but such modes of obtaining the electric light would probably be discontinued by a public body when an economical system of supplying the electric currents has been worked out; and I may say that I have great faith that the municipal bodies would do it better than any other bodies in the country, or than any other means of having it done that we can conceive. I think there should be some degree of elasticity, however, according to which the permission might be sublet, so to speak, to those who can make out a good case that they will do the work in the public interest, and that their doing so will not injuriously interfere with any other public interests, or with the Post Office telegraphs.

The difficulty that has presented itself to our minds is a means of reconciling the desire to promote invention, which comes from individual enterprise, with the rather sluggish methods of promoting invention by municipalities. Take the case of the tramways. Municipalities had the power, according to law, of introducing tramways if they wished, but very few tramways have been introduced by municipalities; they have been introduced mostly by private enterprise. So that there appears to be a difficulty in reconciling individual enterprise with municipal slowness of movement?—It seems to me that some system might be adopted in virtue of which, if a municipality does not undertake the work, after some reasonable time for consideration is allowed, private individuals, or limited liability companies, might have a claim to be permitted to do it, so that the privilege given to the Corporation should never be used on the dog-in-the-manger principle.

Do you not think that, in the present state of electric lighting, where, according to your own statements, great improvements have still to be made, it is desirable not to give anybody a monopoly of it beyond a certain number of years?—Decidedly so.

[Witness then gave evidence as to the application of the electric light for lighthouse purposes, especially as to its use in giving intermittent signals. With reference to the occulting system, he said, that it is as applicable to other lamps as it is to the electric light; but it is easier of application to the latter, because the dioptric apparatus is available, and therefore the system of screens to produce it is more easily applied.]

The CHAIRMAN: Have you thought of it also with reference to the warning lights on ships?

Witness: Yes; ships ought to be very freely allowed to use a fixed electric light, either for a masthead light or, under proper rules, for any other purpose—as, for instance, throwing light over the sea in a direction right ahead, to see what is before them. Just as, in a carriage on a road, a pair of lamps, with reflectors throwing the light forward, are used, so at sea an electric light throwing the light forward ought to be permissive now, and perhaps soon compulsory, on all ships running at above 11 knots speed, in order that for a distance of six miles, at least, right ahead of them, they may have an opportunity of seeing what is there, and that whoever is there may get an early warning that a ship is coming along at the rate of 11 knots or more.

The objection stated against that is, that the ships meeting a vessel carrying an electric light are blinded by the glare, and cannot see well?—There is a good deal to be said practically on both sides of the question there. Quite similar considerations apply to the lights of carriages on roads. I think, however, the balance of advantage will be greatly in favour of a ship carrying a light like that. If it does produce so much glare, it also lights up a large area, and lights up the dangerous area. And here again people will learn not to look at the light so as to have their eyes injured, but to look in the place illuminated by the light, and see what they want to see. The novelty of the electric light is such that, when it is lighted up anywhere, all eyes are directed to it, and many people injure their sight by looking at the electric light; but when it comes to be a practical thing, I think that will not be so much the case.

By Lord LINDSAY: With regard to what I said as to the 2400 candles electric light being produced by 1-horse power, that would be 1-horse power net, after taking off what is required for the friction and heating of the machine. I take the 1-horse power as equivalent to 33,000 lbs., raised one foot high per minute in the usual manner. I think it is very probable, in the present state of things, that the electric light will not damage gas companies, as the increased demand for gas, as a motive power, will counterbalance the loss for lighting power; but, in a state of things that I look forward to, of great central engines working in the most economical way possible, burning not more than 2 lbs. of coal per horse power per hour, this function for gas would be superseded. Still there may be many other purposes for which gas can be advantageously used. Gas, as a direct heating means, will probably have many applications, so that I do not think it probable that less gas will be wanted than at present. I think our means of producing electricity to be greatly in advance of our means of utilizing it.

Lord LINDSAY: On the question of street lighting, you would suggest that lights should be placed at a considerable altitude, say 60 feet, and you spoke about people not objecting to the sunlight, and people not looking at the sunlight; but you have a considerable altitude with the sun, which you could not obtain under any circumstances with the electric light. For instance, if you took an ordinary long street—say 1000 yards long—with one light 60 feet high, if you were at the other end of it, the angle subtended by that 60 feet would be very small, and it would be really right in front of your eyes, would it not?

Witness: Yes; but at so great a distance, the dazzling effect would probably not be inconvenient. If it were 60 feet high, you must be at least 60 feet horizontal distance from it before you had it at an angle of 45 degrees; and, taking a lower angle than 45 degrees, the direct distance between your eye and the light would be proportionately greater than 60 feet. At a distance of 1000 yards the intensity of the light would be so much diminished, that I apprehend there would be comparatively little trial to the eye of any person casually looking at it.

In London, the other day, when the experiments were made at the Albert Hall, there were moderately intense lights exhibited shining down the street in both directions at each approach to the Hall, and I found that even 300 yards away the light was sufficient to dazzle one, and that one could not see a cab coming in the road 30 or 40 yards in front?—In alluding to the various appliances for reflecting the light, such as prisms, lenses, and screens, I might have specified, and I intended to specify, shades put in such positions as shall prevent any eye which should casually meet the light from being dazzled. For example, in such cases as the one referred to, the objection might be got over by having a mere belt screening the light round, instead of having a complete globe, so that by the time the elevation of the light above the observer's horizon is less than 20 degrees, he shall then not be able to look at the light direct, but in such positions it should be screened; and the intensity of the lights would materially rest on the distance between them.

You would have to make certain arrangements as to that?—The object should be to have the illumination on the ground nearly uniform, so that when you are under one light you do not get much more than as much light from that as, when you are midway between two lights, you get from the two.

In that case you would want a smaller amount of vertical light, comparatively speaking; because, if the light were only 60 feet vertically up, and you get the illumination below it equal to one, then half way between the two you would only get illumination equal to one-fourth?—It would be impossible to realize the thing without having a greater elevation than 60 feet. I named 60 feet as seeming to me not greater than might be adopted in practice, but if you could get 100 feet it would be still better; but it is impossible to realize perfect equality. It might be helped again by conical mirrors above the light, by which that part of the light which shows upwards would be shed down for the benefit, not of the places under the light, but of places at a considerable distance from it all round.

With regard to street lights, supposing you have a street lighted with a certain number of these high lights, would they be in series, or in multiple arc, according to your suggestion?—I have not attempted to work that problem out. I see a way of doing it in series, and also ways of doing it in multiple arc. I would rather leave it to practical inventors

to find out what was the best way. I have thought of the subject, but I have not thought of it as to its practical bearing. I think that probably having the lights in series would be the best way with proper means of preventing the current from being stopped when any one of the lights accidentally went out for a moment.

Leaving that and going to domestic lighting, you said you considered it possible, with advantage and with economy, to light any rooms now in any houses, with the exception, say, of bed-rooms, where small hand-lights are required. Would you also say that this should be done in series?—It would depend very much upon the mode of supply. I could scarcely answer that question, because there is so much to be done before it can really be made practicable. I think it would be too expensive at present in private houses, ordinarily, to have separate engines for the electric light, unless in a very large house. In large drawing-rooms, perhaps, it might be advantageous even now. I look forward rather to a time when a block of houses may be lighted by a central engine. Then, I think, it would be economical, with only such electric lamps as we have at present, supposing that some of the lamps perfectly got over the difficulty about unsteadiness. I think the series would be the best arrangement.

Then supposing that we had a block of houses lighted from one station, the current will enter one house, pass through the different lamps in that house, and go into the next house?—Yes; but it would not do to have very many in series, because the electro-motive force would rise too high.

Supposing I had a lamp in the dining-room, and after dinner I did not want it any more, how should I put it out?—If there are other lamps in series you would do it by short-circuiting the current. It may be short-circuited through a resistance, but there will be waste.

Then there is the same cost for that lamp as when it was burning, with the exception of the carbon?—Yes, but with proper regulators, by inventions not yet made, the machine will have a governor, according to which, when you short-circuit any one of the lights, the machine will not give more current than you want for the other light or lights, whether in the same circuit or in parallel circuits.

Such a machine as you mention is now being made, I believe, is it not?—I have not heard. I have scarcely thought of this subject myself, except in a very general way.

You spoke of the application of the electric light to theatres and such like places; but are there any known means of decreasing the intensity of the light such as is required for the footlights of a theatre? You could not lower the electric light with the facilities that we have with gas at present, could you?—It would be done in a different way. One way might be by screens over the mirrors, and another way might be by extinguishing one light, or perhaps two lights.

Do you not consider that having an intense light of this description would be damaging to the eyes of the performers?—No doubt it would. It would need to be properly arranged. I should think that, in order to substitute the electric light for the footlights of a theatre, and to have the theatre altogether illuminated by the electric light, you must use mirrors, somehow or other, properly placed, to give the effect of a row of lights shining up in the direction in which the footlights now shine, and capable of being perfectly regulated by interposing a single screen so as to extinguish the footlights altogether.

That comes rather into the question of economy again; but with a reflection off a plane surface you have a considerable loss, have you not, for every reflection?—A considerable loss.

Even with the best reflection from silver and glass you lose nearly 30 per cent., I think?—I do not know the figure, but a considerable proportion is lost; not so much as 30 per cent., I think, from polished silver; perhaps not more than 10 per cent.

It would become an expensive business if you were obliged to have silver reflectors, would it not?—Electro-silver pieces of copper might serve very well for reflectors. There being no gas burnt, there would be very little sulphur in the air, and the keeping of the silver bright would involve very little rubbing away of the silver, and not much labour.

You spoke of the conductors that you would use for these intense currents as being hollow tubes, and said you would carry water in them, which water you would heat up to a certain temperature, say boiling point. I want to ask you whether the great increase of resistance there would be from heating the wires would be materially felt, considering the vast amount of power carried through?—The resistance would be increased by about 30 per cent., if the copper were allowed to rise to the temperature of boiling water, instead of being kept at the ordinary atmospheric temperature. It would require one-third more copper to give the same effect of resistance; that is to say, to waste the same amount of energy of current.

Do you imagine this would be an economical thing to do, and that you would gain in hot water the interest of the money which you would have to sink in using one-third more copper?—Yes, probably so, if it could be used advantageously. There are many difficulties, of course, in the way of drawing hot water. The water would have to be allowed to flow at frequent intervals into the copper conductors, and then again it would have to be drawn out; and that would have to be done without producing the electric arc, and carrying off the electricity. But all those things can be done.

Now, as to the insulation of these 12-inch copper tubes, which is a serious question. How would you go into such a matter as that? You would have to fix them against the walls of houses, would you not?—It would be very easy to get sufficient insulation in that way, if they were above ground, and I do not think it would be difficult either above ground or below ground to get the requisite insulation.

Supposing that they were below ground, have you gone into the question of the induction which heavy currents, such as would be induced by a 1000-horse power steam-engine, would produce upon telegraph wires?—With a continuous current I think there would be no disturbance of the telegraph wires, except at the moment of stopping. With alternating currents there would probably be serious disturbance.

At what distance from telegraph wires do you consider it would be safe for such conductors to be placed?—I think at a very moderate distance. The Post Office have spoken of six feet, which would be quite sufficient. If it were necessary to come nearer than that, we have means of obviating the induction by crossing the wires, and again by guards. For short spaces there might be complete metallic guards connected with the earth surrounding the conductor; that would practically prevent disturbance.

Referring to what you said about corporations and municipal authorities having power to supply this light, you said you thought that either companies or private individuals should have to apply to corporations for authority; but do you wish by that to infer that I, as a private individual, might not erect a gas-engine in my garden, and illuminate my own house?—No; I think that there should be no prevention of any one doing anything he pleased within his own premises. I do not suppose that is contemplated.

Then you said you considered that no monopoly should be allowed to exist for more than a term of years. By that do you mean that companies should not have facilities for more than a certain number of years, to be fixed at the time they are granted?—They should not have exclusive rights for more than a certain term of years; and the holding of those exclusive rights should, as it seems to me, be conditional upon their using them, or showing reason for their not having been able to use them.

But there would be a great depreciation in the value of the plant which a company had laid down, if there were an arbitrary power of taking away their monopoly at the end of a certain number of years. Supposing I was to start a company for the illumination of a certain street, and my monopoly only gave me five years, and if, at the end of that five years, anybody else liked to come in against me, that would cause a great depreciation of the value of the plant which I had laid down for producing the light, would it not?—It would be necessary to make arrangements for compensation on some equitable basis.

In the event of the electric light being used in towns, there would have to be certain restrictions placed upon the producers as to the quality of the light supplied. How would you suggest that it should be tested?—The quality of the electric light should be very carefully examined—more thoroughly than, so far as I am aware, has yet been done. The first indication known to me (but I must say that I know very little of what has been done on the subject) of anything in this direction, is a statement I had from Mr. Hopkinson. At my request he experimented upon the electric light, and found that it gave as much red light as 2000 candles, and as much green light as 2700 candles; that is to say, he first took the candle power of the electric light seen through a red glass, and found it to be 2000-candle power; he then took the candle power of the same electric light seen through a green glass, and found it 2700-candle power. This makes the comparison comparatively easy. I have myself tried to compare the electric light with candle power, and have utterly failed, because of the great difference of the quality. I took the shadows of an object, say of a pencil, and the two shadows were so exceedingly different in appearance, one of them being of a greenish tinge, and the other being of a ruddy tinge, that I could not tell when the shadows were equally intense. If I had adopted Mr. Hopkinson's plan of the green and red glass, I should have been able to compare the qualities of the two lights. The right way of making an accurate comparison between the electric light and other sources of light, would be by means of prismatic analysis. Take the candle and a prism and lens, and take the electric light and a prism and lens, and focus the spectrum upon an opaque screen; make an aperture in the screen of a certain breadth for the electric light, and perhaps 20 or 30 times as broad for the candle light, and then take the shadows of a pencil, say, as seen not by the whole of the lights, but by the positions of those lights that pass through the apertures in the arrangement as I have suggested.

As to what you would consider to be a standard with which the electric light should be compared, do you approve of using so small a standard as a candle?—Probably a Carcel lamp, equivalent to about 9½ candles, would be more convenient. With such a lamp, and with the arrangement of the larger aperture for the one, and the smaller aperture for the other, probably it might be found convenient enough. But it might be more desirable, and probably more convenient, to have some standard electric light for comparing other electric lights with than to go through the comparatively greater labour of thoroughly testing the quality of a certain standard electric light in comparison with Carcel lamps, or with candles, or with gas lights. The comparison of any light to be tested with another light, something near its own quality, will be much more easy and accurate in common practice than it can be with all the elaborate arrangements that are necessary to compare an electric light of 2700 candles with the light of one candle, or a Carcel lamp of 9½ candles. The difficulties can be got over, but for practical purposes I believe it will be advisable to have a standard electric light.

You would be able to produce a standard electric light, I suppose, by passing definite electro-motive force through a definite resistance?—I should say that you ought to have a very constant and regular electric light of the same quality, or similar to that which is to be used; the engine being regulated and the electric light being of a perfectly definite construction with carbon or carbon and water, or whatever may be the system of lamp which is adopted. I do not see that a glowing wire would have any advantage over a good Carcel lamp, or over a very powerful Argand first-order lighthouse lamp, for comparing electric lights with.

By Mr. Gathorne-Hardy: I certainly consider it undesirable that any undue difficulties should be placed in the way of experimenting with the electric light. I think it desirable that central authorities, like corporations, should have very large powers of giving leave to private individuals, to make their experiments when these involved a slight disturbance of the road. There ought to be very ready means of making experiments, provided that the would-be experimenter shows that he can do so without damaging any public interest, or producing inconvenience or nuisance of a serious kind. I should think it might be a very suitable arrangement, if such power was given to corporations, that there should be an appeal to some central body like the Board of Trade, in order that they might not use that power capriciously and obstructively. It would be objectionable to create any new vested interests that it was possible to avoid creating in the case of a thing that is so much in a transition stage as the electric light is now. It might be necessary, in order to facilitate experiments, and in order to make it worth people's while to experiment on a large scale, to give some vested interests; but at the same time I would restrict vested interests as much as possible.

Mr. Hardcastle: I understood you to say drawing-rooms might even now be economically lighted with the electric light. In saying so, do you mean certain houses might be furnished with steam-engines and electrical apparatus, and still the light would be economical?

Witness: Yes, I think so. The first cost of a gas-engine or a steam-engine is considerable; but the quantity of gas used in a gas-engine to obtain a certain amount of illumination by the electric light would be very moderate. On the other hand, if the power could be supplied from a central engine, the cost would be reduced to little more than the expense of those carbons. Now, carbons more than powerful enough for a drawing-room would cost only 3d. an hour at the most, and that would not be a great expense for a drawing-room, or for a *conversasione*, where there were a large number of guests. The expense of the carbons only goes on during the time the illumination is wanted. Then I look at the expense of the carbons, which is at present the greater part of the expense of the electric light, as quite a transient phase of the economical question. The carbon itself is not thicker than two or three quills; and the value of the material is not more than a 10-1000th part of a farthing. I cannot but think that the cost of the carbons will be reduced to an exceedingly small fraction of the present amount, and this will reduce the cost of the electric light immensely below what it is at present.

But, in the case of the engine for the supply of a single house, you would be obliged to have an engineer, and all the appliances of that kind, would you not?—If it be a gas-engine there is no difficulty. Any man-servant, or even in a house where no man-servant is kept, the servants of the house could start the engine and stop it, and keep it going perfectly.

You suggested a very grand scheme for utilizing the power of the Falls of Niagara, or other water power at a distance. Without going at all into details, was your idea to make use of that power to produce enormous magnetic force, and to convey that force to a distance by wires?—Yes,

to drive dynamo-engines by water power applied in the neighbourhood of the fall, and to use conductors to transmit the current produced by those engines to the places where illumination was to be produced, or where the development of mechanical power was wanted. The light would be produced by the electric lamp wherever it was needed; the electricity would be produced by the aid of electro-magnetic engines driven by the water power.

Would there not be some danger, from such a terrific power being engendered, of those shocks which you described as being possible?—I think not, because it would not be an alternating current; it must be a continuous current.

The Chairman rather appealed to you upon the question of the adoption or non-adoption of tramways as being a fair test of the density, or slowness of action of municipal authorities. May I ask you if you think tramways are such an unqualified good that that is a fair test to apply to municipal authorities?—They are certainly not comparable with such a thing as the electric light.

Sir David Wedderburn: You spoke of the use of large copper tubes containing water. In a general way, what size of tube have you thought of; would it be estimated by inches?

Witness: By inches. It would be very moderate indeed in comparison with water-pipes, for instance. Perhaps the tubes might be three or four inches in diameter, and of moderate thickness. The copper would certainly carry a great deal of electric energy.

Do you consider that there would be any practical difficulty in the insulation of those tubes under ground?—I think there would be no difficulty in giving them sufficient insulation for this purpose.

Lord Lindsay: You spoke about the restriction of vested interests. By that you did not mean that you would do away with the patent laws, did you?

Witness: No, certainly not.

Admiral Sir *Richard Collinson*, K.C.B., Deputy Master of the Trinity House, was then called as a witness; but his evidence solely bore upon the question of the use of the electric light for lighthouse purposes and for ships lights.

Mr. *William Henry Michael*, Q.C., examined by the Chairman.

I have had large experience in regard to the laws regulating the powers of municipal and other local authorities. I have written a book on the subject.

The Chairman: We are trying to find out in this Committee what powers might be given with respect to the electric light. From your experience with regard to similar powers given to undertakings, corporate and other, supplying gas, have you formed any opinion on the subject?

Witness: So far as we have information, I have formed an opinion. At the same time, I must acknowledge that the information we possess is so so very limited, if we compare it with the information we have with respect to the supply of gas and water, that I have formed a very strong opinion that at present we have no sufficient data in order to guide legislation upon the subject.

Would you, therefore, be inclined to allow electric lighting companies, which are rising everywhere, to go on without any legislative restrictions, and give them no legislative powers?—That would depend upon whether they asked for any exceptional powers at the hands of the Legislature.

You are aware that there are 33 Bills before the House at the present moment awaiting the report of this Committee?—I am not aware of the fact. I do not think there are any. I have been concerned, I think, in every single Gas Bill in some way, either for the promoters or for the adversaries; and I think I may say that, in almost every case, the electric light clauses have been struck out.

I know this Committee were appointed on account of a large number of applications for powers to light by electricity?—I think the history of the matter was shortly this: It was found that some municipal corporations were applying, not only to have powers to use the electric light for purposes of public lighting, but also to be put in the position of a company to supply the light for private purposes; that is to say, that they might, for profit, use all the powers of a company, and supply electric light. The gas companies who had made applications, or who were about to make applications to Parliament at the same time (it was at the time of what was commonly called the "scare" about electric lighting, which, as you know, so much influenced the position of gas property in the money market), thought that if it were a matter so valuable to municipal corporations, it would be as well, at least, to take powers in the notices for, and insert clauses in their Bills tentatively, in order that the same power might be conferred upon them, entertaining a strong opinion that, seeing the large amount of capital which gas companies have invested, if any powers whatever were granted, they should come in for a share of the legislative interference; and that if their capital was to be injured and their undertaking was to be depreciated, the Legislature should put them in at least an equally favourable position with corporations who wished to supply the electric light.

There are no Bills referred to this Committee, so that I am not aware what state the Bills are in; but we know there is one promoted by the Corporation of Liverpool?—The history of that Bill was this: A Committee was originally appointed upon the Bill; but, instead of it being referred to a Private Bill Committee, a Committee was struck of the compound character, which we technically call a hybrid Committee, for the purpose of considering the Bill, with a power to all persons to come in and oppose the powers asked for. I happened to be engaged on the other side (for the Liverpool Gas Company), and we all felt that the Liverpool Corporation were placed in a singularly invidious position, which would entail upon them very considerable expense in having, out of their funds, to meet all the opposition in the settlement of what was clearly a great public question. We at once felt that that would be very unjust to the Liverpool Corporation, and I may say that all parties, whether for corporations or for gas companies, felt that it would be very much better that the present course should be adopted—namely, that the whole subject should be referred to a Select Committee of this kind.

You have probably heard that some witnesses think there is very little chance of electric lighting coming into use for public purposes, at all events soon; whilst other witnesses, and especially a very distinguished witness to-day, are of opinion that electric lighting may become a great source of illumination in the future, and that it is necessary to give it encouragement, and prevent its becoming a monopoly in the hands of a single company promoting an undertaking. Have you formed any opinion in regard to what course the Legislature should take, so as not to prevent the development of a new method of illuminating, and at the same time not to constitute a new monopoly?—At the present time I think the action of the Legislature should be *nil*. They have not before them the information which would enable them, as in the case of gas companies, to lay down those proper provisions for the protection of the public, which would allow the development of invention without injury to the public interests.

Of course I am not asking you in your position as advocate against the Liverpool Corporation in that case, but from your knowledge of the law, do you think it would not be a right thing to give a corporation power to use a new mode of illuminating for their own public purposes, if they desired to adopt it?—I should like you to understand that I am quite as much engaged for corporations as I am for gas companies. I may be engaged for three gas companies, and I may have to advocate exactly opposite interests on behalf of three corporations on the same day. Therefore, I am here as an entirely independent witness, although it is true that I have been asked to give evidence by the Association of Gas and Water Companies of the United Kingdom; nevertheless, I do not accept the position of being here as a partisan in any way, but with a desire to aid the Committee in arriving at a decision. With respect to the question that you have asked me, there is already ample power lodged in municipal corporations to do everything that may be required for the purpose of furnishing their districts with light of any kind.

But that is what the Corporation of Liverpool deny. They say that, by a recent decision, they find they may be indicted for a nuisance if they attempt to take up the streets and try to introduce electric lighting by means of wires?—I must say that I know of no such decision, while I know of several expressly to the contrary. One very important case has recently been decided, which, I think, sets this question at rest, although on an entirely different issue, and for an entirely different purpose. A case has been decided by a very high court—the Court of Appeal—which has demonstratively shown that the absolute property in the soil of the streets, for all purposes incident to the carrying out of the Public Health Act (and one of the purposes under the Act of 1875 is to provide means of lighting) is vested in the local authority. I should like that to be clearly understood. The *solum* has always been held to be the property of the individual owner to the middle of the street opposite the premises owned by him; and where there is a street in which the property is owned by a single person on both sides, then the *solum* has always been considered to be in the possession still of the owner, who has dedicated the upper portion of the soil to the uses of the public authority. Now this case has thoroughly decided that the upper portion, that which is necessary to the local authority for the purpose of laying mains, putting down sewers, metalling and keeping in order the surface of the street, and so forth, is vested in, and is as much the property of the local authority as though they were owners in fee; while, underneath that, the soil is still vested in the owners of the property on both sides. That has clearly set at rest any possible question as to the power of local authorities. For all purposes (and lighting is one of those purposes) they can exercise all their powers within the soil, and to a depth which is necessary to carry out those powers, without the risk of being indicted for a nuisance.

Do you know a case which was tried with regard to breaking up the streets in Sheffield, where the Court of Queen's Bench upheld the verdict of a jury at the York Assizes, that a corporation had no power to give to their servants authority to break up the streets for laying down gas-mains?—That raises an entirely different question. Since that case it has always been settled law that there is no power in a corporation to grant power to lay gas-mains where the power was of such a character as would lead to the creation of a nuisance; but, on the other hand, in a very recent case in the neighbourhood of London, the Edgware Board gave to the Harrow Gas Company the power to break up the streets for the purpose of laying their mains, and the Court of Queen's Bench decided that the carrying out of such powers was not of necessity a nuisance. But, at the same time, if the carrying out of the powers be of such a character as to create a nuisance, the mere licence or authority granted by the urban sanitary authority, or by the highway board, will be no answer to an indictment for a nuisance. But that is a different matter. I am now considering, under the Public Health Act (and it was to that that you directed my attention), what are the powers of the local authority to break up the streets in order that those streets should be lighted. I say that ample power exists, and there can be no question at all that a local authority can do anything which is incident to the supply of gas, or oil, or any other means for lighting the public streets. But they come into an entirely different category where they strive to become a trading community to supply light for profit on their own account. There is a great distinction between the exercise of their powers for public purposes, and the *quasi* exercise of their powers for the purpose of supplying light for profit to private persons.

For example, the Corporation of Liverpool might have power to light up their own streets, and to light up, say, St. George's Hall, which is their own property, but they would not have power to sell the light to the Lime Street Station opposite?—Now again you have opened an entirely diverse branch of the subject, that is, as to the propriety of using public funds for purposes for which they were never intended. Any funds they have must be in one or two capacities. They must either have those funds as incident to a municipal corporation, or as incident to an urban sanitary authority. If they have private property of their own, then that private property, which constitutes the borough fund, must be used in accordance with the powers granted to them under the Municipal Corporations (Borough Funds) Act. If they have any funds in the nature of a general district fund, those must be used for purposes incident to the Public Health Act. It was never contemplated that a corporation or an urban sanitary authority should be a trading corporation for the purpose of supplying light, and those powers can only be given by special Act of Parliament.

I understand that you make a difference between their duty to the public and their capacity as traders?—Yes; a very distinct line must be drawn in considering this subject, and you must strictly divide the two purposes of private and public lighting. What is incident to the one does not at all of necessity apply to the other.

You do not agree with the opinion given by counsel to the Liverpool Corporation, when they desired to have the power of laying wires in the streets: "That it is plainly undesirable that the working of any extensive system of public lighting should be carried on under continual risk of indictment"? You do not think that there would be any risk of indictment under the present law? That does not state the case sufficiently. I cannot give an opinion upon an opinion, unless I know the case on which it is founded.

The case, as I understand it, is this: The Corporation, after the decision at the York Assizes, which was upheld by the Court of Queen's Bench, asked their counsel whether they could lay electric wires in the streets, and break up the streets for that purpose; and the opinion given was that it was undesirable, in the present state of the law, that they should attempt to do it?—I say again that, if they confine themselves to public lighting, so far as the streets are concerned, under general legislation they have ample power to do all that is necessary.

But their counsel says not, because it is as to an extensive system of public lighting that this legal opinion is given?—I must criticize the wording; I cannot make the slightest distinction between an extensive system of public lighting and one single public light. If a corporation have the power to break up the streets for a single light, they have exactly the same power to light every public light which is required.

Would it not, in each case, be a question for a jury whether it was a nuisance or not?—I dare say it would. I have already expressed the opinion, in the work which I have published, that all gas companies (and there are a great number of them; I think there are at the present time 700 or more gas undertakings in the kingdom) carry on their undertakings under precisely the same conditions that you have put to me. They are

constantly under the fear of having an indictment preferred against them for a nuisance, and, indeed, they may be indicted, even under a Special Act, for creating a nuisance. The essential power given to a gas company, when they come for statutory powers, is the incorporation of the Gas-Works Clauses Act, which, with its restrictions, gives the power of breaking up the streets for the purpose of laying mains.

But is not the practical difference this—that, whereas it is quite true that a company or a corporation, or whoever it is, have the sole right to supply the light, and are liable to be indicted by anybody who chooses to indict them, if the local authority were to endeavour to supply, say the electric light on a large scale, and break up the roads for the purpose, they would be under the absolute liability of being indicted by the gas company?—No, certainly not, and they could not succeed in the present state of the law; and if that is the opinion given by counsel, I say that he is entirely wrong, seeing there is ample power given to disturb the streets for the purpose of public lighting (I confine myself to that) to the local authority, under the Public Health Act of 1875.

You do not think that there is anything in the second section of the Borough Funds Act, which might, in spirit, go against giving to corporations power for laying down wires for electric lighting: "Provided that nothing in this Act contained shall authorize any governing body to promote any Bill in Parliament for the establishment of any gas or water works to compete with any existing gas or water company established under any Act of Parliament"? This being a new mode of lighting, it would not be in competition with gas-works?—No, certainly not.

And that, in spirit, would not be against it?—I think not. I believe that the general law would be applicable, and that the Legislature would hesitate a very long time before allowing public funds to be used in competition with private enterprise. Rates raised and levied from the public have never yet been allowed to be used in competition with private enterprise, either gas or water.

Do you think that, many persons believing there is a great future before the electric light, you ought not to give such facilities as will lead to the development of the light if legislative provisions are required?—But I do not see that any are required. What are they?

For laying down electric wires in a street, for instance, by the public authority, or, if the public authority do not do it, by a private company?—I do not think that, at the present time, we have any such information as will enable us to deal with the subject, and a very short consideration, I think, will satisfy you upon that point. It must be remembered here that Parliament has never yet given a monopoly to any company for the supply of either gas or water—it is only a *quasi* monopoly; that is to say, in the interests of the public, it has been thought very undesirable that two companies should occupy the same extent of ground, and that there should be two disturbances of the public streets where one would suffice; therefore Parliament has been very unwilling to grant the occupation of a district by two companies. But although Parliament has given power to gas or water companies to take up the streets, there is nothing whatever in the granting of that privilege which would prevent an individual or a company supplying gas or water within the same district without legislative powers; the only objection would be that every disturbance might subject the incoming individual or company to an indictment for a nuisance.

And that practically prohibits it?—It has not had that effect in a great many instances; because, in the case which was quoted, there was the Sheffield Gas Consumers Company established, which went on without any parliamentary sanction.

But they were prevented from carrying out their project?—They carried out their project until they were absorbed in the other Company.

But they were indicted for a nuisance, and they were convicted?—Because they created a nuisance; but it does not of necessity follow that they should create a nuisance, and, besides, the law has been very much altered since that time, and since the decision of the Court of Queen's Bench, that it did not involve a nuisance to take up the streets. But before Parliament granted even that *quasi* monopoly, it was in such a position that it was able to lay down definitive terms under which gas should be supplied. It prescribed, in the first place, in the Gas-Works Clauses Act of 1847, what the price should be; and that price was never to be exceeded under any circumstances. It prescribed what the maximum dividend which the company should earn should be. It prescribed what the illuminating power of the gas should be, and what its purity should be; and now, under the Amendment Act of 1871, it also prescribes the pressure. When the electric light has been brought into such a condition that you may lay down terms for the protection of the public, then will be the time to discuss whether or not there should be similar powers granted; but I have as yet failed to hear any such account of electric lighting as will enable you to lay down the very first term which is essential to the granting of such powers. Where have you evidence which will enable you to fix the rate at which the electric light should be supplied, or its quality, or distribution, or a hundred other matters which have been settled by long experience in relation to the supply of gas?

Take the case of a considerable length of street, from Westminster Bridge to Blackfriars, which is now lighted by electricity. Why should not another length of street of equal length in the Metropolis be lighted with the electric light, and why should not power be given to a company, with the consent of the local authority, to take up the streets for the purpose of lighting such a district?—They have such power at the present time. If my contention is right, all over the country urban sanitary authorities may contract, at the present moment, to supply with the electric light the whole of the streets which are under their governance and direction, and may grant power to a company, or to an individual, to take up the streets for the purpose of supplying such lights.

Supposing that the main wire runs past my house, why should I not have the privilege of taking a wire from it, and lighting my house with electricity if I choose?—For this reason, that the Legislature has very carefully guarded against those abuses which are always unavoidably incident to the mixing up of private enterprise with public funds.

But the case which I am putting hypothetically is this: It is not the vestry who are lighting the public streets; they give a contract to a public company to light the streets, and permission to lay wires. Why should not that public company supply my house with the electric light when they have laid the wires along the street?—I can see no reason whatever why they should not do so. You may enter into any contract you please, but the contract for supplying the public streets must be one and indivisible. The first thing is whether the public authority have made a contract. I will suppose that I am a contractor. I am a society for supplying the electric light. I make a contract with you, the public authority, for supplying the lights, and I have power given to me to open the streets for the purpose. Of course, you would not put yourself, as a private consumer, in an exceptional position. What must be given to you must be given to the whole of the public.

Supposing that the same wire would convey abundance of electricity to light both the streets and the neighbouring houses?—You are supposing that we have arrived at a very much more advanced stage of lighting by electricity than we have at present reached, and that it is brought to the same perfection of convenience as the supply of gas, which you may tap, and supply to individuals in large or small quantities. I say that there is nothing whatever then that would make it at all different from the supply of gas, and that the same power should be granted to the companies, always taking care to protect the public in the same way as the public are protected as regards the supply of gas.

That is to say, you are to give the public some protection for the virtual monopoly which would be granted by allowing the companies to open the streets?—It is a *quasi* monopoly. You have made them statutory companies to a large extent, keeping out all competitors; and therefore the Legislature, I think very properly, says: "As you are absolved from all competition, we must protect the public, and see that you do not get exorbitant profits."

And if the Legislature thought, in their wisdom, that more facilities should be given for the development of the electric light, then you would recommend that those facilities should be given for a temporary period, on account of our ignorance on the subject?—You have now introduced a new element, which is one of very extreme difficulty. Parliament strives, as far as it possibly can, to protect the unwary and the ignorant. What has happened with respect to those limited concessions of which you speak? The public see what is called a 7 per cent. company, the practice being, as you know, in both Houses, to limit dividends upon new capital to 7 per cent. I am supposing the electric light to be placed in the same category by the word "temporary." Our information is as yet so imperfect, that it would not be right to tie up the granting of a concession to a single individual company. But the public are not aware that the concession is so limited that, at the end of 21 years (of which we have examples), the whole of the capital will be gone; and, therefore, the Legislature has been very unwilling to extend those limited concessions, because the public are very much injured. Unfortunately, investors are constantly open, on account of their ignorance of financial matters, to very grave losses; and they have invested their money as though the 7 per cent. were to be perpetual.

Have there not been some cases lately in tramway legislation where, after a very limited number of years, the public authorities are to be allowed to buy up the plant at its cost, without reference to prospective dividends?—And without respect to anything else but its value as old iron; and unless the companies have been so prudent and farseeing as, out of profits from time to time, to lay by sufficient money to constitute a sinking-fund, so as to recoup the original shareholders, the whole of their property is gone.

Is not that the fault of the investors? If investors are so imprudent as not to look after their own interests, is that very much for the Legislature to consider?—They always have considered it. It is quite true that the maxim, "*Caveat emptor*," ought to apply to all these transactions, as well as to going into a shop and buying a yard of ribbon; but we know that the public are uninformed on all these financial questions. If it were, as you say, that the public are to protect themselves, then you might say that all restrictions upon the supply of gas and water should be removed. But there is this cardinal difficulty to be overcome in this case; with respect to tramways, you have occupied the street for once and all, and there it is. In the present imperfect state of our knowledge, you grant to-day to a company a *quasi* monopoly for the supply of the light. Next week, or next year, the whole of the subject may be revolutionized. We may then get some opportunity of knowing how to store up electricity, how to divide it and distribute it, and how to get rid of those difficulties which seem to a good many persons at the present time to be insuperable. But in the meantime you have tied up the public; you have prevented their having the advantage of that improved knowledge, for you have granted a concession for 21 years.

I did not grant a concession, even hypothetically, for 21 years; I spoke of seven years. The time that it has taken to develop the electric light to its present condition has been 60 years; you would not suppose that there would be such a tremendous revolution in two or three years. But would not the argument cut the other way—that if you give them, under the Legislature, no facilities at all to open the public streets, you are retarding invention infinitely more?—I cannot see it. I have never yet seen a case for opening the streets by an electric company. It is not as it is in the supply of gas, where you want an enormous main, which has to traverse a very long distance. You have no evidence at present that there is any possibility of storing up electricity.

If there is not evidence as to the possibility of storing it up, there is evidence that you may have an engine working with perfect steadiness, as you have the engines working the ships crossing over the Atlantic, for 12 days, never ceasing a single revolution, and all that time producing a steady outflow of electricity. Is it not equivalent to storing up, that your engines are now so steady and so well made that you can perfectly rely upon their turning round equably, and producing a vast amount of electricity, which would supply large districts?—Yes, but there is a fatal blot on the whole matter. I will follow your own hypothesis, because in my view it is simply an hypothesis. You have a perfect machine, and it is competent to supply six houses with 30 lights each. There are six houses in a row, and you have some outbuildings, or some place of that kind, from which you can send power to supply the six houses, and there is a perfect light. Then comes a time when the whole of the lights are turned out except two, in two bed-rooms. The engine must go on; you have no stored-up electricity—you must be making the 180 lights in precisely the same way as if you were only making 2; and I fail to see how you have established, with any information that I have had, any analogy between that system and the storing up of gas, which enables you to lay down a main, and to carry through it your supply, whether it is the smallest or the greatest, at identically the same expense.

The difficulty which you have mentioned just now did exist, and does exist to a large extent; but the progress of invention is so rapid that you will find that probably it will not be many days more without being solved?—That will revolutionize the whole question. The moment you are able to store up electricity, I acknowledge at once that there you have entered on a new phase of the question.

Not storing it up, but economizing its use; that was your point?—You have not quite followed me. I say that, for supplying the two lights, your engine must make the same number of revolutions, must turn your expensive machine; you must be incurring the whole of the expense, except merely that involved in the burning of the carbon points, or whatever it may be. Putting that out of the question, the whole of your expense is precisely the same for 2 as for 180 lights. I say that this reduces the matter to an absurdity as compared with gas.

Lord LINDSAY: I was informed a few days ago that a patent is now being applied for which will answer your question.

Witness: As soon as I see the specification for that, and see it in practical work, I shall admit that the time has come for legislation on the question.

The CHAIRMAN: This Committee would not have been appointed if it was not obvious that lighting by electricity is growing rapidly. Should you not give ample facilities for the development of this new art, without imposing any restrictions which may come between it and the public?

Witness: Yes; the same as I would to the supply of oil, or petroleum, or any other matter. I would allow every one to have the fairest possible play. I do not argue that, because the gas companies have a very large

sum of money invested in their undertakings, they are to act in restriction of the progress of science. If a better light is developed, the gas companies must suffer.

In fact, the gas companies have no *locus standi* at all as regards this light, have they, in the question of having a monopoly of lighting any district?—Only by gas. But I want to point out to you how this has worked to the detriment of the gas companies, and I take it from the evidence which has been given before you. I will take the evidence of Liverpool itself, and I will point the moral by a history of that case. So far as I am aware, at the present time there is only one single case in which an urban authority have themselves supplied gas without the intervention of a gas company; that is to say, while there are a great number of municipal authorities supplying gas, they have, in every case, as far as I know, except Manchester, purchased the undertakings of gas companies, and they are extremely anxious to purchase gas undertakings. If matters go on as they have been going on for the last few years, in a very short time the whole of the supply of gas and water in this kingdom will be in the hands of the municipal authorities. They are striving to get possession of these electric lighting powers, for the express purpose of depreciating the value of gas property, and I object to it very much, as one of the public. I say that there should be no intervention by the Legislature which will allow money which has been invested in good faith to be lost to shareholders; but I say, at the same time, that no restriction ought to be imposed upon the development of science, so long as that scientific development does not enure to the detriment of existing interests sanctioned by Parliament.

Supposing the Liverpool Corporation say, in evidence, that it is very desirable to light certain large public thoroughfares and other places, as well as their own public galleries and St. George's Hall, and that it is very desirable to light up their docks with the electric light jointly with the Dock Company; of course their doing so to a certain extent will be in competition with the Gas Company, because they now light up the docks; but if the Corporation ask for power to supply public places with the new illuminating agent, why should they not do it?—I see no objection whatever with respect to the Liverpool Corporation using the electric light for the public lamps. I say, whatever the value of my opinion may be, that they have ample power to-day to take up the streets and light every thoroughfare in the borough of Liverpool. I say that the Dock Company have ample power within their premises to do the same thing without legislative interference. But, if these bodies want power to become trading communities, I say there is no reason why the Corporation of Liverpool should become a trading community for the supply of electricity. If they can do it cheaply and well for the public thoroughfares, by all means let them do it, and if further powers are required, let them be granted to them. So the Dock Company within their own premises want no power. If they want power for it, let them have it; but do not create a monopoly, by the exercise of which you will injure the public.

I understand your position as between public and private trading, but I am not equally clear as to your explanation why a public company, at the present moment, should not be allowed to use the streets for supplying private houses, if they wish it, although I quite see with you that if they do so we must put in some restrictions which will secure the public interests?—If you are prepared to put in such restrictions as will thoroughly protect the public, I do not object to their having power granted to them; but I say that the time has not arrived.

You are aware that the wires put down are a very insignificant disturbance of the street, as compared with the laying down of gas-pipes?—No, I do not think so; because if you are to cut a trench, it does not matter whether it is 3 inches wide or 12 inches.

As a question of nuisance, does it not matter whether you cut off half the street, or only an insignificant space by the side of it?—Practically, you disturb a street once in a lifetime for the supply of gas—I am speaking of the gas-main. Of course you take off branch pipes every day, and it is these which create the nuisance, because you cut across the footpaths.

The practice of Committees of both Houses has been, I think, to disallow competition by rates with private enterprise?—Yes, and you will find that this is strictly carried out in the general legislation under the Borough Funds Act, to which you referred me. For the first time, in 1875, lighting was made a sanitary purpose. There was an incidental power given under an Act in 1849, by which sanitary authorities were enabled to contract for a period of three years with any company or person for lighting the streets and thoroughfares of their districts; but in 1875 they were enabled to supply gas both publicly and privately, and the supply of gas was made a sanitary purpose. But with respect both to lighting and to water, the Legislature carefully guarded all companies with statutory powers, and said that where any such company existed in a district, and adequately fulfilled their functions of supplying gas and water, the public rates should not be used in competition with private moneys, which had been invested for the purpose of carrying on the operations of those companies. With respect to gas, under the Gas-Works Clauses Act of 1871, for the first time, gas was made a commodity different from bread, butter, meat, clothes, or shoes. Up to 1871, a gas company established within a district were not compelled to supply gas; that is to say, if the gas company had any animosity against any person asking for gas, or had any reason for not supplying him, they were not called upon to supply. But by the Act of 1871, gas companies are obliged to supply gas over the whole of their districts; that is to say, if any person, within 25 yards of one of their mains; calls upon them, they are obliged to supply gas; the local authority, however little the remuneration may be, may call upon the gas company to lay down 50 yards of mains simply to supply the public lights. Under those circumstances the Legislature has protected gas companies, and said that, where a gas company exists in a district, the public authority shall not supply gas for profit, neither indeed can they make gas for the supply of public lights. But the fact of a gas company being in the district does not prevent the use of any other material—oil, petroleum, or electricity, &c.—for public lights; and, during the last three years, there have been several disputes between gas companies and sanitary authorities, and the gas lamps have been put out, and for a long period the public lighting has been carried on with oil.

Although the Legislature has shown itself very jealous of allowing the public rates to be used in interfering with private companies doing similar work, it has not been always so, has it? Take the case of the rates used for establishing a public library, which certainly comes into competition with circulating libraries. Supposing that Mudie had possession of the field in a town, the ratepayers money is allowed to be used for the establishment of a library, and interferes in that way with private competition?—I draw a great distinction between that kind of private enterprise, which means that any shopkeeper who sells books and who keeps a circulating library is, to a certain extent, competed with by a public library. But he is only one portion of the community; it is not a company who have had special sanction to do a special thing by the authority of Parliament. There is a great distinction between persons who have invested their money on the faith of a *quasi* guarantee by Parliament that they shall carry on their business without interference, and persons who have invested money without any such guarantee. Gas is a particular thing. You may sell books in any shanty you please, in a stall in a street; but you cannot make gas in every house—you would create such an intolerable nuisance all over the town, that it would be impossible to live in it; and, therefore, Parliament takes into consideration matters of that kind.

And gives certain privileges for the large capital invested?—Certainly, and, as I venture to think, is bound to a certain extent to protect these companies. But I guard that by saying, at the same time, that if the public interests require that the gas companies should suffer, then suffer they must.

Lord LINDSAY: Although you think that the time has not come for facilities being given to public companies or municipal authorities, still I suppose if I, personally, were to pay the royalty to any companies got up for producing the electric light, I might produce that light for my own benefit without having to seek any power?

Witness: Assuredly.

Mr. PULESTON: You said just now, in speaking of Liverpool, that they have power now to use the electric light in the public lamps; but it was stated strongly, in the evidence here, that they could not do so?

Witness: I am very sorry to hear it. I think it is very bad law.

I, for instance, personally questioned two of the witnesses, I think, the Engineer particularly, and they spoke unequivocally upon that point, saying that they had not the power to do any such thing?—I should have great confidence in that gentleman's opinion as an engineer—he is a very able man as an engineer—but I am not prepared to say that I should accept his ruling on a point of law.

He professed to speak upon the authority of the municipal law officers?—I refer you to the Public Health Act of 1875, and to the latest decisions on the point, that the whole of the soil necessary for their purposes is vested in the local authority.

I asked the question particularly a second time, because I was very much astonished, personally, when I heard the statement that he made; but there was no doubt that he derived his impression, if not his actual instructions to that effect, from the law advisers of the Corporation of Liverpool. You would say, I presume, that it is desirable to improve the lighting of streets in some way, whether by gas or by electricity?—I think it cannot be improved; I do not believe that the adoption of electricity would be in any way an improvement on the present system of lighting. If you ask me whether the streets are perfectly lighted, I answer you unhesitatingly, No. But why? On account of the parsimony of the local authorities. They depend, in truth, upon private individuals who have shops, which shops, when open, give an adequate amount of light; but when the shops are shut, the thoroughfares are in darkness. Sanitary authorities all over the country are reducing the amount burned from 5 to 4 feet per hour per lamp, to economize their lighting rates, and they are putting the lamp-posts at such a distance that there is a stratum of darkness between every two lights; and then they complain of the quality of the gas, whereas in reality the bad lighting has been brought on by their penuriousness rather than anything else.

Then you would illustrate that, I dare say, by the St. James's Vestry, who refuse to go on with the improved system of lighting in Waterloo Place?—I would rather not mention any particular case, but it must be in the experience of every one who has walked through the London streets, and seen how our thoroughfares can be adequately lighted when the gas companies are allowed to put up proper lights. You do not want to pick up a pin in the streets. It is absurd, in thoroughfares of the width that we have in the Metropolis, to talk of lights of 1200 and 2000 candles. If adequate lights were put up every 40 or 50 yards, with good burners, all the purposes of lighting would be accomplished.

You probably saw the gas lights that are now discontinued in Waterloo Place. Is it your opinion that those lights were as good as the electric lights on the Embankment?—I think they were, for all purposes, very much better; but, of course, on that matter I speak merely as one of the general public.

Does it follow, as the result of your investigation, that the use of electricity, so far as it is now applied to public halls, and even an extended use of it, would necessarily diminish the use of gas?—I do not think so.

Do you not think that the further use of electricity would create a demand for more gas, and would do away with this penuriousness to which you have referred?—That I very much doubt. I believe there is very deeply set, in the minds of all persons elected by the ratepayers, great impatience as to the expenditure of money for these purposes, and they will keep down the rates as much as they can; but I do not think that there is any antagonism between gas and electricity. For certain purposes, electricity will every day become more valuable; for certain purposes, the use of gas is inevitable. I heard the evidence to-day of the very distinguished gentleman as to the lighting of private dwellings; but he, although he is a most eminent scientific man, cannot have paid attention to lighting for general purposes. You do not want, in a drawing-room, one great mass of light; you want a hundred sources of broken up and diffused light, which electricity cannot give you. If you come to a place like the Albert Hall, or Exeter Hall, where you want a mass of light to flood the whole space, and diffuse it all over the building, there electricity becomes extremely valuable, and also in great open spaces, where you want a great concentration of light for a particular purpose. There is a great future before gas. I believe that what was called the "scare" will improve the quality of gas, and will show gas companies the various purposes to which gas may be applied, such, for instance, as heating purposes; then, again, electricity can be most cheaply produced by the use of the gas-engine, particularly in small quantities; and there are many other modes of applying gas.

Mr. SPENCER-STANHOPE: I think that we have not had an explanation from you on one point. Supposing that I have a shop or premises on one side of the street, and I choose to light them by my own engine, by the electric light, and I wish to light some premises, of my own or my neighbour's, on the other side of the street, what power have I to do that?

Witness: You have precisely the same power as you would have to sell a ton of coals: or if some one had sent you two hams, you might sell one to your neighbour opposite.

But how am I to get the wire to him?—Of course you would be liable to an indictment for nuisance if you created a nuisance in so doing, and I cannot think that you ought to be taken out of the category of ordinary individuals. If you broke the law in supplying the electric light, I think you ought to be brought under the provisions of the law.

You do not think that any power should be granted by the Legislature to meet private enterprise of that kind?—I quite fail to see it. A shopkeeper might, with equal justice, ask for Legislative power for every individual purpose of his merchandise and trade.

Mr. TALBOT: Do I correctly understand you to say generally that where local authorities have statutory power to break up streets for the purpose of laying down water and gas pipes, they may, in the exercise of their power, also lay down wires?

Witness: Yes, certainly, if it is necessary. The words are general in the statute. It says that they may do all things that are necessary for the purpose of supplying the district with light, and may grant powers to individuals to do it.

Then, in point of fact, they need not come to Parliament at all?—Not at all for public lighting.

Mr. HARDCASTLE: In the case just put to you in reference to a shopkeeper laying wires across a street, which no doubt might be called a nuisance, would the gas companies have the right to complain of the nuisance?

Witness: Not in any way as gas companies.

They would have no right to complain of it as a nuisance, inasmuch as it diminished their profits?—No, they would have no legal status whatever; they would be entitled to complain simply as inhabitants whose free use of the streets had been interfered with by the digging of the trench, or the laying of the line of pipe.

Did I correctly understand you to say that under the Tramways Act the ratepayers, or the local authorities, become possessed of the tramways merely at the price of old iron?—So it seems to me; there is an option. It is always bad to quote a statute without having it before one; but, as far as I am aware, in the Act which has granted the Tramway Company authority to lay down the rails, there is a power granted to the urban authority to come into possession of those rails at the end of a certain period; and, as there are no profits to be given, it would be simply the structural value, which would be very small; the value of the stones would be very small, and they could be carried away; so that if the Tramway Company had not constructed a sinking-fund out of their profits year by year, the whole would be lost to the Shareholders.

Lord LINDSAY: Supposing I light my house on one side of a street, and wish to communicate my light to a friend opposite, and I do not break up the street, but carry my wire from one window to another, I might be indicted for a nuisance, I suppose, because if you stretch wires between one sounding board and another you get a sort of æolian harp sound. Might I be indicted for a nuisance for that, and if I were indicted, would it go before a jury?

Witness: Yes, certainly, if an indictment were preferred against you for a nuisance; but I cannot see how it would be such a nuisance to the public as would render it likely that you would be convicted. The mere making of a sound in that way would not be such an injurious thing as to come within the legal definition of a nuisance.

Mr. HARDCASTLE: But would not the risk of the wire breaking cause a nuisance?

Witness: No, I think not. One of the reasons why telegraph wires have not been extensively carried overhead lately has been the fact that they sometimes broke and cut people's heads off; but I do not think that that would support an indictment for a nuisance. It must be of such a general character as constitutes a nuisance at common law.

[The Committee then adjourned to Friday next, the 13th of June.]

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

FRIDAY, MAY 30.

(*Before Lords Justices* JAMES, BRETT, *and* COTTON.)

SWANSTON *v.* THE TWICKENHAM LOCAL BOARD OF HEALTH.

This was an appeal from a recent decision of Justice Fry, and raised a question on the construction of the Public Health Act, 1875. The case is one of considerable importance to Local Boards, and was reported in the JOURNAL for March 18, p. 400.

The plaintiff is the owner of land on the south side of Station Road, Twickenham, and the defendants had constructed under that road a sewer nearly 30 feet from the surface. They had also constructed on plaintiff's land a side entrance, or "man-hole." The effect of this structure, as plaintiff alleged, was to prevent his tenants from using the land on which it stood, and the defendants claimed to have a perpetual right to go upon the plaintiff's adjoining land for the purpose of descending the shaft and bringing sewage up. The plaintiff's tenants complained that intolerable stench and sickness had been caused by this opening, and that cases of fever had broken out in consequence thereof. The plaintiff claimed an injunction to restrain the defendants from continuing the man-hole on his land, situated in Station Road, and also from constructing any other such side entrance to the sewers on any part of his land, and Justice Fry was of opinion that under the clauses of the Act giving the defendants power to make sewers there was no power to construct these side entrances, or man-holes. If such were necessary for the purpose of the sewer, the defendants must purchase the land under their compulsory powers.

Mr. J. PEARSON, Q.C., and Mr. VAUGHAN HAWKINS appeared in support of the appeal; Mr. HIGGINS, Q.C., and Mr. E. J. PAYNE were for the plaintiff.

Their LORDSHIPS held that the man-holes were part of a sewer within the meaning of the Act, and that the plaintiff was not entitled to require the defendants to purchase the land, but was only entitled to compensation for such injury (if any) as he had sustained.

The decision of Justice Fry was accordingly reversed.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, MAY 29.

(*Before Vice-Chancellor* BACON.)

HESKETH *v.* THE BOLTON GUARDIANS.

Sir HENRY JACKSON, Q.C., moved for an injunction to restrain the Guardians of the Poor for the district of Bolton from draining the workhouse in such a manner as to be a nuisance to the plaintiff.

Mr. MILLAR, who appeared for the defendants, said the motion was clearly irregular, as would appear from the following dates. The writ was filed on Aug. 3, 1877; statement of claim delivered, Jan. 11, 1878; reply, April 6, 1878; and consent, on May 9, 1878, to try the cause upon affidavit, the plaintiff's affidavits to be filed within one month from May 9, 1878, and the defendants within one month after the plaintiff's affidavits had been filed. The plaintiff, instead of filing his affidavits within the time specified, had taken over a year, and now asked for an injunction restraining the paupers contributing their proportion of the sewage of the district. He should contend there had been a most extraordinary abuse of the process of the Court, and that the motion ought to be refused with costs. He wished to answer the affidavits, and to cross-examine the witnesses, but had had no time to do so, in consequence of the plaintiff having only filed his affidavits on Tuesday.

The VICE-CHANCELLOR said that even assuming what had been said on the part of the defendants to be correct, there might yet be a case for an interlocutory application, and, therefore, he had better hear the motion.

Mr. MILLAR said he must ask for time to answer the affidavits.

Sir H. JACKSON said the delay had not been all on one side. Latterly the nuisance had become intolerable, either through the paupers increasing in number or unhealthiness, and he wished to restrain it before the hot weather set in. He would suggest that the motion should stand over till the hearing, and that an early day should be fixed for the trial.

After some discussion, the motion was ordered to stand over, the defendants to have one month within which to file their affidavits; Tuesday, July 8, being fixed as the day for the trial of the cause.

QUEEN'S BENCH DIVISION.—THURSDAY, MAY 22.

(*Sittings in Banco, before the* LORD CHIEF JUSTICE *and Justice* MELLOR.)

IN THE MATTER OF THE BIRMINGHAM CORPORATION AND THE WEST BROMWICH IMPROVEMENT COMMISSIONERS.

It may be remembered that on the 23rd of last November, as reported in the JOURNAL for the 26th of that month, page 779, the Corporation of Birmingham applied for, and obtained a rule *nisi*, calling upon the West Bromwich Improvement Commissioners to show cause why the award made in the arbitration between them and the Corporation, to determine the amount to be paid for a transfer to them of a portion of the Corporation gas undertaking, should not be set aside, or referred back to the Umpire, on the ground that it proceeded upon a wrong principle of valuation.

The ATTORNEY-GENERAL, the SOLICITOR-GENERAL, Mr. MICHAEL, Q.C., and Mr. C. BOWEN appeared for the Corporation of Birmingham; Mr. MATHEWS, Q.C., Mr. WEBSTER, Q.C., Mr. YOUNG, and Mr. PEMBROKE STEPHENS were for the West Bromwich Commissioners, and the Tipton, Oldbury, and Smethwick Local Boards, who were all interested in the case, as it was agreed that the principle settled in the West Bromwich arbitration should govern their cases.

The ATTORNEY-GENERAL now moved that the rule be made absolute. He said it was a rule to set aside, or refer back to the Umpire, the award made by Sir Henry Hunt in the matter of an arbitration by Mr. Bramwell and Mr. Hawksley, the well-known engineers, in reference to the costs to be paid to the Corporation of Birmingham by the Improvement Commissioners of West Bromwich for the purchase of the right of manufacturing gas and also the distributing plant in the district of West Bromwich.

Mr. MATHEWS said he appeared to show cause against the rule. The matter arose in this way. In the year 1874 there were two Companies supplying gas to Birmingham and its neighbourhood—viz., the Birmingham Company, with an area of supply limited to Birmingham alone, and the Birmingham and Staffordshire Company, with an area extending twenty miles round Birmingham, including West Bromwich, Sutton Coldfield, and many other places. The Staffordshire Company, who had works in Birmigham and also at West Bromwich—the Swan Village Works—had raised capital to the amount of £670,000, on about one-half of which (£320,000) they were allowed a dividend of 3 per cent., and on the remaining portion 7½ per cent. There was also a limitation in their Act of Parliament fixing the price of gas at 4s. per 1000 cubic feet. The Corporation of Birmingham, in 1874, proposed to buy the undertakings of both Companies, the effect of which would have been that the Corporation would have had the right of selling gas to the outlying districts not under the Corporation, but governed by local bodies, and the profits arising from the sale would have accrued to the Corporation alone. The agreements made by the Corporation with the two Companies were scheduled in the Act which ultimately authorized the purchase. By the Act, local bodies in the districts were entitled to promote Bills in Parliament to effect the purchase of portions of the plant situated in the various districts. The West Bromwich Commissioners were subsequently empowered to buy "that portion of the gas undertaking now of the Staffordshire Company which is contained in West Bromwich, except the West Bromwich works," and the other districts in like manner. One arbitration was to settle the principle of the purchase. The Swan Village works, by the scheme, were to remain in the hands of the Corporation, because they were too big for any one Authority to own, and it would be inconvenient for several to own one works. From the first, Birmingham merely acquired the works subject to sale to the neighbouring Authorities. The second schedule of the Birmingham Corporation (Gas) Act, 1874, as to the agreement with the Staffordshire Company, was important, as setting out what was sold—"the whole undertaking of the Company and their works, and all their rights, powers, and privileges connected therewith, as the same shall stand on the day on which the purchase is actually made." The price to be paid was an annuity equal to the maximum dividend, with a bonus of £10,000. This being the case with the Act of 1874, in November, 1875, four districts gave notice of their intention to apply for powers to purchase. These were West Bromwich, Tipton, Oldbury, and Smethwick. Section 6 of the West Bromwich Act recited that "if within two months of the passing of the Act the Commissioners shall give notice of their intention to purchase that portion of the whole undertaking which is contained within their district, except the land and the West Bromwich works, and the mains going therefrom to Birmingham, then the Corporation shall sell, and the Commissioners shall buy, such portion of the whole undertaking except as aforesaid." This was to be read together with section 40 of the Corporation Act. Two years time was given to complete the purchase, and during that time the Corporation were to maintain the works and mains in good condition. A title-deed was to be made out on completion of the purchase, and thereafter the undertaking purchased from the Corporation was to be vested in the Commissioners. The deed of transfer to West Bromwich was only to cover a part of the undertaking purchased from the Staffordshire Company by the Corporation. The West Bromwich Act left the purchase really where it stood under the Corporation Act, but there were some modifications, with provisions made for extensions and additions made by the Corporation. The Tipton Act was similar. Under their Act the West Bromwich Commissioners gave notice to purchase on the 10th of August, 1876, but there was some delay in the arbitration. Some difficulties arose in the case, and the Birmingham Corporation made a claim against the West Bromwich Commissioners, and said they would show how much profit could be made out of the Swan Village works upon every 1000 feet of gas sold. They said they would show that they made a profit of 1s. 6d., and for that purpose they would isolate the works.

The LORD CHIEF JUSTICE: How did the dispute arise?

Mr. MATHEWS: The dispute was as to how much the West Bromwich Commissioners were to pay for the purchase of that portion of the undertaking of the Staffordshire Company which was in West Bromwich, except the works. The Staffordshire Company had three gas-works, and the Corporation said the Commissioners were taking the plum of the undertaking, and would have to pay accordingly. The Corporation went largely into figures to show how much gas was consumed, and what might be expected from the undertaking in the future. It was shown that 9½d. per 1000 feet would have paid the maximum dividend that the Company were authorized to make, and the ingenious contention of the Corporation was that while the Company were limited in their dividend to an average of 8 per cent., the Corporation had no limit at all put to their earnings, and that by their Act they had obtained an exemption from the old dividend. To this the West Bromwich Commissioners replied, "No, that construction is not reasonable; the only thing you are to sell to us is the undertaking of the Staffordshire Company, as purchased by you." The arbitration resulted in a finding that the West Bromwich Commissioners were entitled to pay for the works at the fair value of their portion of the total undertaking as the Corporation obtained it. The Corporation, however, claimed to sell the property not as they bought it, but as they had improved it and cheapened the cost of the production of gas, and also because of the freedom from any limit upon the profits. It would be seen that it was a very important matter for these districts when he mentioned that every

additional 1d. per 1000 feet profit added to the price of gas meant £14,000 to be paid by the West Bromwich Commissioners.

The LORD CHIEF JUSTICE asked what the arbitrators had done.

Mr. MATHEWS: They awarded £70,750 to Birmingham as the sum to be paid by the West Bromwich Commissioners for the right to make gas in West Bromwich.

The LORD CHIEF JUSTICE: What jurisdiction have we in this matter? This is under an Act of Parliament.

Mr. MATHEWS: Absolutely none beyond common law jurisdiction.

The LORD CHIEF JUSTICE: Common law jurisdiction does not extend to proceedings under an Act of Parliament.

Justice MELLOR: How can we say they are wrong in the determination of principle?

The LORD CHIEF JUSTICE: If we have no jurisdiction, we are really wasting our time.

Mr. MATHEWS: I am at a loss to see how you can overrule the arbitrators, unless the award is bad on the face of it.

The ATTORNEY-GENERAL: The award which was made by Sir Henry Hunt appears on the face of it to be contrary to the Act of Parliament.

The LORD CHIEF JUSTICE: Assume that to be a fact, for the purposes of argument, how does it give us jurisdiction? The statute gives us no authority.

The ATTORNEY-GENERAL: Take the case of an ordinary arbitration.

The LORD CHIEF JUSTICE: But that is under a rule of Court.

The ATTORNEY-GENERAL: But this is under a rule of Court.

The LORD CHIEF JUSTICE: But is there power for us to interfere? It is an award under the powers of an Act of Parliament. I quite agree, if it was an ordinary agreement to refer, it would be a different thing; but, as I understand it, the Act gives express directions as to how the matter shall be dealt with.

[It having been pointed out that the Lands Clauses Consolidation Act was incorporated in the Act under which the arbitration took place, the Court held that this gave them jurisdiction to review the award.]

The ATTORNEY-GENERAL said that this point had been fully considered by the parties, and he thought he might state that everybody was anxious that the Court should decide this case. Even the Umpire was anxious, and had framed his award with a view to have the point at issue decided.

Mr. MATHEWS disclaimed any dissatisfaction with the finding of the arbitrators, as his clients were thoroughly satisfied with it, and were now being put to great expense in the matter. The Corporation were dissatisfied with the finding, because the Umpire had done wrong in leaving out of his award any calculation as to the improved value of the undertaking since it came into their hands. Referring again to clause 40 of the Corporation Act, he argued that Parliament had in view a desire to put all parties on the same footing, and that the West Bromwich Commissioners were entitled to buy at the same price as that at which the Birmingham Corporation purchased.

WEDNESDAY, MAY 28.

Mr. WEBSTER, on behalf of the Oldbury and Smethwick Local Boards, said that by the Act of Parliament authorizing the transfer of the Staffordshire Company's Works to the Corporation, "the whole undertaking of the Company and their works" were sold, "and all their rights, powers, and privileges connected therewith, as the same shall stand on the day on which the purchase is actually completed," and the price paid was equal to the maximum dividend of the Company, with a bonus of £10,000. The districts formerly supplied by the Staffordshire Company had the privilege of applying for powers to act under clause 40 of the Corporation Act, and the four districts—West Bromwich, Tipton, Oldbury, and Smethwick—obtained powers. One of the clauses of the West Bromwich Act recited that "if within two months after the passing of this Act the Commissioners shall give notice of their intention to purchase that portion of the whole undertaking which is contained within their district, excepting the Swan Village works and mains therefrom to Birmingham, then the Corporation shall sell and the Commissioners buy such portion of the whole undertaking." West Bromwich and the other districts gave notice, and the question under argument was what construction the Act of Parliament should bear—whether the districts were entitled to purchase at the proportion of price which the Birmingham Corporation paid for the whole undertaking, or should pay on the scale of enhanced value. The arbitrators were Mr. Bramwell and Mr. Hawksley, and they referred their differences to Sir Henry Hunt, who awarded £75,000 in the West Bromwich case, on the principle that the Corporation were not entitled to profit by reason of the enhanced value of the works. The Corporation in this and the other cases claimed £300,000. The history of the case was as follows:—The Corporation made two agreements in 1874—one with the Birmingham and Staffordshire Gas Company, and the other with the Birmingham Gas Company. The former supplied gas to a large number of places outside the town. The Corporation came to Parliament in 1875 to confirm an agreement which was to put them in the position of the Staffordshire Company, and enable them to supply twelve districts, including West Bromwich, these districts being outside the town limits, and not under the control of the Corporation. It was an unprecedented thing in parliamentary legislation—one local authority taking power to supply others. The districts, in opposing the Bill, had this end in view—that they were desirous of having powers conferred to supply gas on their own account within their own districts. The only objection they could take to the Birmingham Corporation acquiring such powers was that they would make profits, no doubt legitimate enough, out of districts not within their municipal limits. Parliament expressly negatived, on the face of the Corporation Act, the right of Birmingham to make profit out of districts not within the town. As presented, the Bill contained no power to hand over any portion of the undertaking to the outlying Authorities. On the *locus standi* of the outlying Authorities being admitted after a strenuous opposition from Birmingham, clause 40 was inserted for their protection. By that clause the Corporation were bound to sell out to the districts in case the Bill should pass, and it was provided that one arbitration should decide the principle of valuation. What, in the view of the West Bromwich Commissioners, was the principle to be determined? How was that portion of the Staffordshire Company's undertaking to be valued?

The LORD CHIEF JUSTICE: The Birmingham Corporation being authorized to buy from the Staffordshire Company, the price between these bodies had been already ascertained, and I presume that the West Bromwich area would form a portion of the items out of which the aggregate price was calculated. I should have supposed that when Parliament reserved to the West Bromwich Commissioners the right to come the following year, and without any power of contention on the part of the Corporation, to buy back a portion of what Birmingham had purchased—I should have thought the simplest solution would have been to pay the same amount that Birmingham did.

Mr. WEBSTER: That was our case.

The LORD CHIEF JUSTICE: Parliament must have intended that Birmingham should not make profits out of West Bromwich as a speculation, but that West Bromwich should be entitled to buy up the part of the undertaking in their own area, free of all profits.

Mr. WEBSTER said that the Birmingham Corporation purchased the whole of the Staffordshire Company's undertaking for £1,457,250. That was capitalizing the annuities at 25 years purchase, at 6 per cent. The case for the Birmingham Corporation was that, in consequence of the removal of the restriction on dividend, which took place when the concern came into their hands, and by reason of the greater economy in working, the undertaking was now worth £3,306,000 (and another valuation put it at upwards of £4,000,000); and the contention of the Corporation was that the West Bromwich Commissioners should pay their proportion of £3,306,000, or £4,000,000, as the case might be, although only a year before the Corporation were called on to pay only £1,457,250. In other words, they bought the West Bromwich portion of the undertaking for between £60,000 and £70,000, and now asked £250,000 or £300,000 for it. There were three manufacturing works of the Staffordshire Company, of which one was at Swan Village, in the West Bromwich area. The Corporation desired to retain those works, and a contest arose, in which the object of the Corporation was to enhance the value of the distributing works, and diminish the value of the manufacturing works; while the object of the Commissioners was to reduce the value of the distributing works, and enhance the value of the manufacturing works. The Corporation said the latter were worth only a fifth, but the other side said they were worth at least a third of the whole amount paid. He agreed that if the Staffordshire undertaking was worth more than the Birmingham Corporation gave for it, the Local Authority ought to pay their proportion of that better price; but he denied that there was a single word in the Act of Parliament obtained by Birmingham to swell the advantages for the purpose of obtaining a higher price for parts of the works from the separate districts. Assuming that before the Bill was in Parliament, one of the Local Authorities had heard of what was to happen, and had gone to Birmingham and said: "Look here, you are going to Parliament for powers to supply us with gas. We are not going to stand that; but we shall go in for a Bill with you." The Corporation must in that case have admitted the outlaying Authority as a joint promoter.

The LORD CHIEF JUSTICE: Suppose another case. Suppose instead of going to the Birmingham Corporation they had gone to Parliament for an independent Bill, and Parliament had passed that Bill?

Mr. WEBSTER: Parliament must have given to the West Bromwich Authority the same advantages that Birmingham obtained.

The LORD CHIEF JUSTICE: Will you say that when Parliament reserves to West Bromwich the right of coming with an independent Bill, which the Corporation could not oppose, it was exactly the same thing as though they had passed a Bill in favour of West Bromwich, except that it was a general bargain?

Mr. WEBSTER: I used that very argument, that the parties were remitted to their rights as they stood in 1875.

The LORD CHIEF JUSTICE: Tell us what has been done, that we may see plainly the contest.

Mr. WEBSTER said the Umpire awarded £70,750, and it was expressly given as compensation to be paid by the West Bromwich Improvement Commissioners to the Corporation of Birmingham for the purchase of that portion of the undertaking of the late Staffordshire Company, as purchased by the Corporation under the Act of 1875, which was at the date of the passing of the West Bromwich Improvement Act contained within the district of the Commissioners, except the land and works excluded, together with any extensions thereof, and additions which had been made by the Corporation in the ordinary course, as purchased by the Corporation. It could not be suggested that the award itself was bad. But then came the enunciation of principle—the principle upon which the award was made—and which, under clause 40, the arbitrators were bound to state. The principle of the valuation was as follows:—The sum fixed is the value to the seller at the date of the certificate of notice to purchase; and the subject-matter is the portion within the district of the purchasing body with any exceptions contained within the special Act of Parliament of the Corporation, unenhanced by advantages resulting from the purchase by the Corporation under the Act of 1875. The argument of the Corporation was founded upon subsection 2 of section 8. It had been contended by Mr. Michael that the general award which gave to the West Bromwich Commissioners the rights and powers which had been exercised by the Corporation so long as they remained the suppliers of gas to the West Bromwich district were to be construed as meaning that the Commissioners were to pay to the Corporation an enormous sum of money for the accident that the Corporation could economize the working expenses, and had no limit placed on their profit. But those words were subject to the provisions of the Corporation Act and the West Bromwich Act that the sale should comprise all mains, plant, &c., "together with the rights, powers, and privileges of the Corporation in relation to the manufacture, sale, and supply of gas." If the West Bromwich Commissioners had come to Parliament in 1875, they must have obtained the same privileges as the Corporation, because, as Mr. Chamberlain said, speaking as a witness at the arbitration, "So far as he knew, or as anybody else knew, nothing in the nature of a limit of dividend had ever been put on the Corporation." The Corporation had made two valuable agreements with the Gas Companies by which the supply of gas to the outlying districts would have been handed over to the Corporation; but Parliament provided that the Local Authorities might purchase portions of the undertaking as if it were the undertaking of the Staffordshire Company, and not as if it were the undertaking of the Corporation. But the whole objection to the arbitration was that the arbitrators had considered the subject-matter unenhanced by the fact that in the hands of a public authority like the Corporation of Birmingham there were advantages of working which enabled them to obtain a better return. So far as the principle was concerned, he maintained that the Court had no jurisdiction, for it was that which the arbitrators laid down, and the only circumstances under which the award could be set aside would be if the arbitrators had taken a wrong view of the two Acts of Parliament. If it could be shown on the face of the award that it was bad in law, and that the arbitrators had wrongly construed the Acts of Parliament, it might be that there was jurisdiction. The award could not be attacked, but the principle might. He submitted that the Corporation never were to be compensated for the accidents or incidents of their existence having enhanced the value of the gas-works in their hands, and that the profits of the undertaking legitimately belonged to the consumers and ratepayers of West Bromwich.

The LORD CHIEF JUSTICE: The Act of Parliament under which the Corporation acquired the undertaking expressly declared that "the Corporation shall have the power to oppose on clauses;" and when the West Bromwich Commissioners went to Parliament for their Bill to acquire the right to possess that portion of the Staffordshire Company's undertaking which was included in their area, then would have been the time for the Corporation to say, "We cannot oppose your Bill, but we can oppose you on clauses, and we will now ask Parliament to insert a clause that the rights which we as a Corporation have shall be taken as an element in settling the price which West Bromwich shall pay to us."

Mr. WEBSTER insisted that it was the duty of the Corporation to do so, if that was the view they took of their position. The enhanced value they were now seeking to obtain was assuming the gas supply to be a commercial

undertaking in their hands. He submitted generally that one award was made on a sound principle, and should not be disturbed.

The ATTORNEY-GENERAL then addressed the Court in support of the rule. He said: The whole question depends upon the construction to be placed upon the Birmingham Act of 1875, coupled with the West Bromwich Act of 1876. I shall endeavour to convince your lordships that really and truly the whole matter must depend upon that construction; but before examining the provisions of the statute, I will explain what the contentions are on the one side and the other. I think I can show your lordships that before the Act of 1875 they had agreed that the property should be purchased, which agreement they had a right to make, and then the provision inserted in this Act of Parliament was that the Local Authority of West Bromwich, if they desired within a certain time to supply themselves with gas, should be at liberty to do that upon purchasing their portion of the undertaking from the Corporation of Birmingham, and paying the Corporation of Birmingham what the subject-matter was worth to them. I think I shall be right in raising this question in any ordinary case—that in fixing the price to be paid for any subject-matter, the principle to be followed is what the property is worth to the vendor, and not to the purchaser. Ordinarily that principle must prevail.

The LORD CHIEF JUSTICE: If the price of gas had gone down, would the Corporation say they ought to have had less paid to them?

The ATTORNEY-GENERAL asked what would have been the position if the electric light had come into vogue, and the West Bromwich Commissioners had obtained their Act. They would certainly have objected to paying the proportion of the price which the Corporation had paid to the Staffordshire Company, but would have paid what it was worth now. His argument was that Parliament said to the Local Authority, "We do not want to deprive you of the power of supplying your own districts. You may get Acts to enable you to do that; then you can buy such and such a portion of the undertaking of the Staffordshire Company, and you must pay the Birmingham Corporation what it is worth." The undertaking was of more value to the Corporation than it was to the Company, because the Corporation were under no restrictions as to the amount of the profit they might make, because they had greater capital, and better means of making advantageous contracts, and greater power of economizing. It was of more value, not because the Corporation was a corporation, but because it was a powerful body, with the command of a large capital. He submitted that what the arbitrators had done was not to fix the principle of valuation, but to fix compensation, and had done so in a way that was not provided for in the Act of Parliament; and if that was shown on the face of the award, it was a matter in which the Court had jurisdiction. Parliament meant what Parliament had said—namely, that a particular subject-matter should be sold and purchased, and that the purchaser should pay the value of it.

The LORD CHIEF JUSTICE said that in 1875 the Local Authorities opposed the Corporation Bill, on the ground that it made a material difference to them whether they were supplied by the Corporation or by the Company, because the Corporation enjoyed privileges which the Company did not, and the result might be that the Corporation might tax them much more highly than the Company. Then they claimed that if the Staffordshire Company got rid of their undertaking, they (the Local Authorities) should be placed in as good a position as the Corporation of Birmingham, and not that every shilling of profit made out of their district should be spent for the benefit of Birmingham.

The ATTORNEY-GENERAL said the West Bromwich Commissioners were not in a position to say that.

The LORD CHIEF JUSTICE said he could understand no other ground on which that provision was put in, that they should have the right to purchase in the course of a year or two.

The ATTORNEY-GENERAL said he could understand perfectly well Parliament interfering in favour of West Bromwich, in order to give the district, at some time or another, the command over its own gas supply. But he did not think it necessary to assume that Parliament did this because it was reluctant that Birmingham should be in the position to make a profit out of West Bromwich and the other districts, and to spend the profit not upon West Bromwich, but upon Birmingham itself. As to the supply of gas, there could be no doubt about this, that Birmingham undertook to supply gas to all the outlying districts at the same rate at which they supplied it in Birmingham itself. It was made compulsory upon the Corporation to do so, and it never could have happened that West Bromwich could be injured by the transfer. The districts were in no worse position at all. Of course, Birmingham was obliged to apply the profits in certain ways, but if West Bromwich had a grievance, it was purely a sentimental one.

Justice MELLOR: But you are under no obligation not to increase the price of gas.

The LORD CHIEF JUSTICE: If you wanted to build a new and magnificent town hall, like Manchester (I do not know whether Birmingham has one)—if you wanted anything of a public building of any sort, a museum or anything else, and you chose to raise the price of gas in order to take a surplus for that purpose, what is to prevent you?

The ATTORNEY-GENERAL: The limits and the obligations are greater on the Corporation than those which were imposed on the Staffordshire Company. The maximum price that could be charged by the Staffordshire Company was 4s. per 1000 feet, and our maximum price is 4s.; but there is this further obligation imposed by the Act of Parliament, that the Corporation shall not charge any outside districts any more than they charge in Birmingham itself. Of course, I quite appreciate your lordship's observations about building a town hall, but it is very improbable the inhabitants would submit to build a town hall by raising the price of gas.

The LORD CHIEF JUSTICE: I am not quite so sure of that. The whole district would then have to contribute to assist Birmingham in building the town hall, and it might well be worth while, on the part of the people of Birmingham, to submit to raising the price of gas.

The ATTORNEY-GENERAL: Every single inch outside Birmingham is only one-sixth of the whole undertaking—one-sixth of the supply. West Bromwich is only 1-20th part of the supply. But the same observations would apply to the Staffordshire Company. Supposing the Staffordshire Company had erected works or a new office, they might have raised the price of gas if the customers would have stood it.

The LORD CHIEF JUSTICE: The Act prohibited it.

The ATTORNEY-GENERAL: Only to the extent of 4s.

Proceeding with his argument, the ATTORNEY-GENERAL endeavoured to show that the Corporation acquired very definite powers under their agreement with the Company before going to Parliament.

The LORD CHIEF JUSTICE: They could not have gone on without this Act of Parliament.

The ATTORNEY-GENERAL: Why not? So far as the Staffordshire Company were concerned they could.

The LORD CHIEF JUSTICE: The going to Parliament rather shows it.

While the Attorney-General was arguing on the different powers the Corporation possess compared with the Company,

The LORD CHIEF JUSTICE asked him to turn back and see what the Staffordshire Company were to sell to the Corporation. The Act said it should be lawful for the Company to sell "all or any other rights, powers, and privileges," showing that that had relation to the manufacture and supply of gas by the Company. It shows that the term, rights, powers, and privileges, meant the powers conferred by Act of Parliament on the Company. They were the rights and privileges of the Company which they were giving to the Corporation. They were the privileges of manufacturing and selling gas, and they were the same rights as were possessed by the Company, and no more.

The ATTORNEY-GENERAL: Here the Act says the Corporation shall sell certain rights and privileges.

The LORD CHIEF JUSTICE: Just as the Company did, and no more. The Corporation acquired rights and privileges from the Company, and these they transfer to the West Bromwich Commissioners.

The ATTORNEY-GENERAL: My argument goes to this. I say the Corporation have belonging to them certain property, and they have the right to sell and supply gas, and if they are to part with this they are to get all that the property is worth to them. If your lordships take the view that they were not entitled to the increased price which would be occasioned by the power they have as a Corporation of earning any amount of profit which they chose, Parliament might have said so.

The LORD CHIEF JUSTICE: Ought not the Corporation to lower the price of gas so as just to meet the cost of manufacture and supply?

The ATTORNEY-GENERAL: The Act of Parliament does not say so. It says the contrary.

The LORD CHIEF JUSTICE: Surely the Act of Parliament does not put the Corporation in the position of a commercial company? That would be contrary to the functions of a governing municipal body.

The ATTORNEY-GENERAL: The Act of Parliament expressly provides how the profits shall be applied.

The LORD CHIEF JUSTICE: That is, the profits made after they have reduced the price of gas as low as they can reduce it.

The ATTORNEY-GENERAL: Upon that assumption they would make no profit, because if they are to reduce the price of gas to the lowest limit, they must just barely make both ends meet.

The LORD CHIEF JUSTICE: You are quite right. If there is any reserve they are to carry it to public purposes, but are not to assess the price of gas beyond what is necessary. If anything remains they are to carry it to the proper funds. They are not to make it a commercial speculation; they are not a commercial body; and I cannot help thinking that an arbitrator, who is to settle the price at which an undertaking should be purchased, ought to take these things into consideration.

The ATTORNEY-GENERAL: Then no corporation will ever purchase gas-works again.

The LORD CHIEF JUSTICE: So much the better! Why should they?

The ATTORNEY-GENERAL: The answer is that Parliament has allowed them to purchase. It may be of advantage for corporations to acquire such undertakings. They do not take the profit to themselves; it goes to the community.

The LORD CHIEF JUSTICE: But how can we suppose that Parliament intended to give the Birmingham Corporation the right to make a profit on the sale of gas, such profit to be applied not for the benefit of the whole district, but for the benefit of the borough? Why should the Corporation be placed in the position of the Gas Company, with additional powers and privileges?

The ATTORNEY-GENERAL: The answer is that Parliament did not see any harm in it. Parliament thought the gas undertaking could be better managed under the Corporation.

The LORD CHIEF JUSTICE said that when Parliament, under the Act of 1875, was asked to rectify the agreement between the Company and the Corporation, and West Bromwich opposed the Act, it was very strong evidence to show that Parliament did not give to Birmingham powers over Bromwich if West Bromwich was inclined to purchase powers for itself.

The ATTORNEY-GENERAL: Why did not Parliament say so?

The LORD CHIEF JUSTICE: It has said so. It says West Bromwich may buy within twelve months.

The ATTORNEY-GENERAL: Under those powers of the Corporation? All I contend for is that under the provision of the statutes the West Bromwich Commissioners are to pay for what the Corporation are to sell, and they are to pay the worth of it to the Corporation, and not the worth it might have been to the Staffordshire Company.

Mr. MICHAEL also addressed the Court on behalf of the Corporation. He said the Gas-Works Clauses Act of 1847 limited companies in two ways—first as to dividend, and then as to price. But the Corporation of Birmingham had power to earn a larger dividend within their maximum, and the universal mode of estimating the price to be paid for the transfer of an undertaking was to find out in the first instance the amount of profit which could be earned in perpetuity. That was bought up at 25 years purchase. What he complained of was that the arbitrators had undertaken to distinguish between the principle of compensation and the principle of valuation.

Justice MELLOR observed that apparently, by the terms of the Act, the Local Authorities of the district were not to be treated as strangers, but as parties having *ab initio* a bargain with the Corporation, and he took it that that was the principle on which the arbitration proceeded.

The LORD CHIEF JUSTICE asked what Mr. Michael had to say on the question of jurisdiction to review the award, because that at present seemed to be a difficulty.

Mr. MICHAEL replied that the arbitration was under the Companies Clauses Consolidation Act, and the submission had been made a rule of Court. The arbitrators had exceeded their powers in dealing with the subject-matter. What they ought to have done was to determine the mode of valuing, but, instead of that, they had determined the subject-matter to be compensated.

The LORD CHIEF JUSTICE: You say that the difference arises from the different way in which the Corporation do their business, and because they have made a larger profit than the Company, they are therefore entitled to charge the higher price to the Commissioners. You do not show any change in the price of coal, or any of the circumstances which determine prices and profits, but that, being a Corporation, and having a large area, they can manage cheaper than the Company could.

Mr. MICHAEL said that was one of the contentions at the arbitration.

The LORD CHIEF JUSTICE: That is, it is a relative value, and not an absolute value.

Mr. MICHAEL: It is only one element of the enhanced value; there is the more important one of the removal of the restrictions to make profit.

The LORD CHIEF JUSTICE: Again that is relative. It really comes to this. In the hands of the Corporation the undertaking can be carried on cheaper than it could by the Company.

THURSDAY, MAY 29.

Mr. BOWEN also argued on behalf of the Corporation. He contended that the Court had ample jurisdiction to send the matter back to the arbitrators for re-consideration. If the Corporation were right, what was referred to the Umpire was to take into his hands section 40, and give the Corporation compensation for their interest in the undertaking at the time of the notice to treat, and to find the money value of their interest at that time.

The LORD CHIEF JUSTICE: No doubt, if you are right—putting it hypothetically. The question is if you are.

Mr. BOWEN said in this part of his argument he claimed to be allowed to suppose he was right in the construction of the section. Then assuming that his construction was correct, the Umpire had not done his duty. That was tolerably clear upon the award, because he said in the award what he did consider the subject-matter, and what he had to do. He had said, "I will not give you compensation for the interest of the Corporation at the time of the notice to treat; I will only give you compensation for the interest of the Corporation at the time they purchased from the Staffordshire Company." That was not what, if the Corporation's view of the construction of section 40 was right, he was entitled to do; and, if they were right on section 40, the Umpire had not done what the Companies Clauses Consolidation Act directed him to do; and as the submission might be made a rule of Court, the case came within the jurisdiction of the Court. Now, what was the principle?

The LORD CHIEF JUSTICE: If you are right, there was no principle.

Mr. BOWEN contended that no principle of valuation had been followed by the arbitrators.

The LORD CHIEF JUSTICE: In order to see what is the principle, it is necessary to see what the Legislature meant in passing that section of the Act.

Justice MELLOR: You want to abstract from the valuation all the history of the case and the circumstances under which the Corporation of Birmingham acquired the property.

Mr. BOWEN admitted that, if the Corporation were wrong in their contention, the award could not go back to the arbitrator; but if right, this was one of the cases that the Court would send back.

The LORD CHIEF JUSTICE said that as at present advised he should hold that the Umpire had determined the principle of valuation. He arrived at the conclusion that the Legislature never meant, when it authorized the West Bromwich people to bring in a Bill, and made it compulsory upon the Corporation of Birmingham to sell, that West Bromwich, when they came in, should be in a worse position than the Corporation when they bought.

Justice MELLOR: He did not intend you to make a profit from the transaction.

Mr. BOWEN: If that were so, on the first point our argument would fail.

The LORD CHIEF JUSTICE: I think that is the effect of what the Umpire says. It is not artistically done, not clearly stated, but I think that is the effect, taking it altogether.

Mr. BOWEN: All I at present desire to say is that if the view of the law I submit be correct, then the Umpire has not done what he was bound to do. He says: "I determine the principle of valuation to be as follows:—The sum fixed is the value to the seller at the date of service of notice to take the subject-matter of the purchase." Now, that is curiously inconsistent with what follows. We say that it ought to be the value to the seller at the date of the service of notice to purchase. But further on he departs from that salutary view.

The LORD CHIEF JUSTICE: Oh, yes. He says you must take the value at that time as being that which it would have been if there had been no enhancement in the value from the advantages resulting from the purchase. It is inconsistent in terms, but in substance we can follow it. What he meant he has not said; but what he meant, if he had said it, would be right.

Mr. BOWEN said that what he wished to establish was not that the Umpire had used language which was not artistic, because that was not material; but he contended that he had misconstrued section 40 of the Act of 1875, and had interpreted it as meaning that the sellers were to have an equivalent, not for the interest they had in the undertaking at the time of the sale, but at some other time. The West Bromwich district was a district no doubt supplied by the Staffordshire Gas Company, but they had no vested right.

Justice MELLOR: But they had a *locus standi* before Parliament.

Mr. BOWEN: But they had no vested right to say to the Staffordshire Company, "Give us part of your undertaking." They had no vested right, if somebody else was buying the Staffordshire Company's undertaking, to say, "You shall not buy unless you give us part." They had the right to come to Parliament, and undoubtedly Parliament would let them in, so to speak, to share in the purchase.

The LORD CHIEF JUSTICE: That could only be upon the ground that they had a right to resist the introduction of the Corporation into the Local Board district of West Bromwich, which did not belong to the Corporation. If the concluding section of the Act of 1875 had been opposed by them, I take it that it would not have passed. The Legislature would have said, "You, the Corporation, are limited in your powers and functions to the borough of Birmingham. You now seek to introduce yourselves into a place outside, to be the manufacturers and sellers of gas. We will not allow you to do that. You have no business to go beyond your functions in your own district." I assume that would have been done, because Parliament did say this in 1875.

Mr. BOWEN urged that there were many advantages accruing from the Corporation undertaking work of this kind.

The LORD CHIEF JUSTICE: But all the districts have Local Authorities of their own.

Mr. BOWEN: Yes, now they have; but they had not at the time.

The LORD CHIEF JUSTICE: The true principle of valuation was to ascertain not what was the amount of profit, but what was the lowest price at which gas could be sold by the Corporation. Would they, in the discharge of their public duty, be justified in keeping up the price? Yet it was upon the principle of their having the power of raising the price and making as much profit as they could out of the undertaking, that you say the principle of valuation is to determined.

Mr. BOWEN demurred to going as far as that in his argument.

The LORD CHIEF JUSTICE: That is the effect of your argument.

Mr. BOWEN then urged as to the relation between the subsequent Act of 1876 and the Act of 1875, that surely section 40 had nothing to do with the expressions in the subsequent Acts.

The LORD CHIEF JUSTICE said they did not attach much importance to that. The other Act specified the machinery to carry out section 40, whatever that section might be.

After a short deliberation, the Court delivered judgment in favour of the West Bromwich Commissioners, upholding the award.

The LORD CHIEF JUSTICE said: I think the rule must be discharged. The arguments on both sides have been conducted with great ability, and everything has been said that could be said on the subject, and I can only regret that so much ability and so much valuable time should have been wasted in construing an Act of Parliament which might have been made perfectly clear by a very few words. It is lamentable that the valuable time of such a Court as this should be occupied in construing Acts of Parliament which one would think were purposely left obscure. However, we must do the best we can. I quite agree that all turns on the meaning to be put on section 40 of the Birmingham Corporation Gas Act, 1875; but I think that in construing that section we are not only entitled, but are bound to take into consideration the position of the parties at the time that section was introduced. It is true that in a clause of the Staffordshire Gas Company's Act, 1845, the Company took power to sell, and the Birmingham Corporation acquired power to buy, the undertaking of the Staffordshire Gas Company. There the matter appears to have slept, and no parliamentary powers other than what were contained in that section of the Company's Act were acquired by the Corporation. It is true that an agreement was executed between the Company and the Corporation, but it was absolutely necessary, before that agreement could be carried into effect, that the Corporation should obtain parliamentary powers; amongst other things, power to raise the necessary funds to enable them to complete the purchase of the undertaking. Well, they came to Parliament, and they proposed to obtain fuller and more complete powers to complete the purchase, and take upon themselves the undertaking of the Company. But in the meanwhile the districts outside the borough of Birmingham which had their own Local Urban Authorities, finding that the Corporation of Birmingham were going to Parliament to obtain such an Act, interposed, and insisted each of them on having this very important part of the urban regulation left to the urban authorities of the different districts; and it appears that a compromise was come to which is embodied in the 40th section of the Corporation Act. The West Bromwich Commissioners said to Parliament, "Do not pass this Bill so far as we are concerned," and each of the twelve districts said the same thing, so that a formidable opposition was made to the passing of the Bill in question, and a compromise was effected, and we have to see what that compromise was. Practically, it seems to me to come to this. The Birmingham Corporation said, "You districts do not oppose this Bill; we are willing to make terms with each of you. At any rate, so far as the borough of Birmingham is concerned, you have no *locus standi*, and everything will be gained, and no prejudice can be done to either, if you allow the Bill to pass, subject to the condition or provision to which we agree—namely, that if you choose, within twelve months or two years, to come in and agree to have that portion of the undertaking which belongs to each of you, you shall have the opportunity of doing so." That is embodied in the section which provides that the Corporation shall not oppose the application to Parliament, except on clauses, if either or any of those Local Authorities introduced a Bill into Parliament within a given time to purchase their portion of the undertaking. The words are "that the Corporation shall sell, and the Local Authority shall buy, such portion or portions of the said undertaking in the manner hereinbefore mentioned;" and then came an important proviso:—"And one such arbitration (that is, an arbitration under the Companies Clauses Act) shall determine the principle of valuation between the Corporation and any other Sanitary Authority. What is meant by this stipulation, that one arbitration shall determine the principle of valuation? The arbitrator has put his construction upon it, and two questions arise—one is whether the principle of valuation which the arbitrator has laid down is the right one; and the second is whether this Court has any jurisdiction to interfere in the determination at which he has arrived. The principle which he has laid down, when we consider the whole of what he has said, comes to this: The Act of Parliament gave to the Local Authorities the right—a right which has not been questioned—to buy. It gave that right in exactly the same manner as the right to purchase from the Staffordshire Company was given to the Corporation of Birmingham by the Act of 1875. West Bromwich objected to being included in the undertaking, which the Corporation desired to purchase. Said the Corporation, "If you will let this Bill pass, and apply to Parliament for a Bill to take this portion off our hands, we will not oppose you." The arbitrator says, "What was meant by that section was, that West Bromwich should be entitled, when it passed its Bill, to come in on exactly the same terms as the Birmingham Corporation when they purchase from the Staffordshire Company. It never was intended that circumstances that might have intervened should be considered, that any manipulation of their powers by the Birmingham Corporation, so as to raise the value of the undertaking, should operate to the prejudice of West Bromwich when it came in, not to acquire, but to make absolute, the right to purchase under the 40th section." That is the view which the arbitrator appears to have taken, and I cannot bring myself to think that that view of the matter is wrong. And for this simple reason—that I cannot suppose that when the Legislature passed the Birmingham Corporation Gas Act, it could have been in the contemplation of the Legislature that the Corporation were to turn the rights and powers which they had acquired into a commercial speculation, under which it would be competent—by good management, if you please, but still by management—for the Corporation to use those rights and powers with a view to commercial gain, or for any other purpose than for the benefit of the public. Consequently, I assume that it was the intention of Parliament that there should be no such thing as profit, except accidental profit, in the management of such an undertaking. The business of a corporation is not to make a profit. They have to supply the consumers with an article on the cheapest terms possible, and if a profit is made it is pointed out how it is to be applied. But it could not have been in the contemplation of Parliament, and ought not to have been in the contemplation of the Corporation of Birmingham, that this should be a speculation out of which they were to make a profit for the benefit of their borough. And what makes it more striking is, that the profit is not applied to the benefit of the outlying districts, but to the benefit of Birmingham only, and I cannot suppose that that was ever in the contemplation of the Legislature. I suppose that the Corporation have bought this undertaking of the Staffordshire Company on fair terms; and the fair and politic construction of the section is to assume that the price given by the Corporation was the right price, and that when West Bromwich came in to take its share it should have it on the same terms as those on which Birmingham acquired it from the Staffordshire Company. Therefore, when it is said that the principle of valuation is to be ascertained, it is not that the interest of the Birmingham Corporation in the undertaking is to be ascertained. If that were so, there would be no necessity for saying the arbitrator should determine the principle of valuation at all. If, then, it is decided that that question was to be left to the arbitrator, the next question is, have we power to interfere with his determination? I cannot see my way to such a conclusion. If the Act of Parliament were clear in its meaning, and if the arbitrator had mistaken its meaning, and had proceeded upon a principle evidently at variance with the Act of Parliament, then I think that Mr. Bowen's argument would be right, and that we should have power to intervene. But I do not see my way to a definite understanding of what is meant by the principle of valuation, and I do see that that is left to the arbitrator; and I think he has—not clearly, but in language which is very loose—stated the principle of valuation upon which he has proceeded. I do not see my way to the conclusion that we have jurisdiction to interfere with his decision; but if we had such jurisdiction, all I can say is that I think the arbitrator has determined rightly. I think the rule should be discharged.

Justice MELLOR said he concurred in the whole of the Lord Chief Justice's judgment. He could not help saying that, notwithstanding the ingenious mode in which Mr. Bowen had endeavoured to state his contention about the principle of valuation, he confessed that he did not think he had established his point, or had given any better or more reasonable construction of the word "principle" than the arbitrator had done. In

his opinion, the matter was entirely one for the arbitrator, and not for the Court. One of the parties desired to purchase, and the other agreed to sell a portion of an undertaking in which the buyers had had an interest. The West Bromwich Commissioners went to Parliament to oppose the transfer of the undertaking to the Corporation unless certain terms were imposed for their benefit, and the same thing was done by the other outlying districts similarly situated; and Parliament consented to the Bill passing, on an arrangement being come to between the parties that Birmingham was willing to sell and the districts to buy those portions of the undertaking contained within their districts. What Parliament intended was that the principle upon which the purchase was to be completed should be one which should determine not only the question between the Corporation and West Bromwich, but the case of all the others who might be in a position to take advantage of the clause, and the principle which the arbitrator had to settle was, what would be just and equitable between the parties. Although he did not think the award was perhaps artistically expressed, yet it was easy to see the principle on which the arbitrator had gone, and he did not see anything wrong in it.

Rule refused accordingly.

Mr. MATHEWS, on behalf of the Local Authorities of the outlying districts, applied for costs, remarking that the Tipton, Oldbury, and Smethwick Local Boards had been kept waiting pending the decision in this case.

The COURT ordered costs to follow the event.

COMMON PLEAS DIVISION—SATURDAY, MAY 31.

(*Sittings in Banco, before Justices* LINDLEY *and* LOPES.)

PARRY *v.* SMITH.—LIABILITY OF GAS-FITTERS.

Mr. FINLAY and Mr. GORE were counsel for the plaintiff; Mr. WADDY, Q.C., and Mr. OPPENHEIM were for the defendant.

This was an action tried before Justice Lopes at the Guildhall. The plaintiff was in the employ of Messrs. Moses and Sons as one of their housekeepers, and the defendant was a gas-fitter employed by them to repair a gas-meter in a cellar attached to the premises where the plaintiff was employed. The defendant found it necessary to take away the meter to repair it, and replaced it by a temporary connection, consisting of a flexible tube, one end of which was pushed into the inlet-pipe, and the other end into a pipe communicating with the house. The ends of the pipe were bound round with rags and string and puttied up, and a drawer was put under the curve of the tube so as to support it and take the weight off the fastening. After the temporary connection had been so placed by the defendant and he had gone away, the plaintiff, whose duty it was to turn on and light the gas in the cellar, went there for that purpose with a light, when directly he opened the door an explosion occurred, and he was knocked down and seriously injured. The jury, in answer to questions left by the learned judge, found that the defendant was negligent in doing the work, and that the accident proceeded entirely from such negligence, and they assessed the damages at £50. At the close of the plaintiff's case, Mr. Waddy for the defendant submitted there was no case to go to the jury. The learned judge, for the purpose of the day, ruled that there was, but reserved judgment until the points of law which had been raised had been argued before him. The matter came on in due course, and this morning his lordship delivered a written judgment in favour of the plaintiff.

His LORDSHIP said: It was contended for the defendant that there was no cause of action, unless there was privity between the plaintiff and the defendant, or unless what was done by the defendant amounted to a public nuisance, or unless there had been on the part of the defendant fraud, misrepresentation, or concealment. On the other hand, it was contended for the plaintiff that the action would lie, because the defendant knew he was dealing with gas, a thing highly dangerous in itself, unless great care and caution were used in its management; that the plaintiff's right of action was founded not on contract, but on the duty which attaches to the use of or dealing with a thing in its nature highly dangerous, and likely to cause damage unless managed with great care and caution. I think the plaintiff's right of action is founded on a duty which I believe attaches in every case where a person is using or is dealing with a highly dangerous thing, which, unless managed with the greatest care, is calculated to cause injury to bystanders. To support such a right of action there need be no privity between the party injured and him by whose breach of duty the injury is caused, nor any fraud, misrepresentation, or concealment, nor need what is done by the defendant amount to a public nuisance. It is a misfeasance independent of contract. It is strange there is no direct authority on this point. A large number of cases were cited, but none of them directly in point. [His lordship then dwelt at some length on the cases cited in support of the defence.] These are not cases where the alleged cause of action is in respect of a breach of duty in using or in dealing with a thing in its nature dangerous and likely to cause injury unless great care is used. There must be judgment for the plaintiff for £50 and costs.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in May, 1879:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen — As Nitrates, &c.	Ammonia. — Saline.	Ammonia. — Organic.	Hardness (Clark's Scale). — Before Boiling.	Hardness (Clark's Scale). — After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	21·11	0·067	0·141	0·000	0·006	14·3	3·7
West Middlesex	21·00	0·070	0·135	0·000	0·006	14·3	3·7
Southwark and Vauxhall	21·80	0·069	0·111	0·000	0·006	13·2	3·3
Chelsea	20·20	0·058	0·135	0·000	0·006	14·3	3·3
Lambeth	20·90	0·036	0·135	0·000	0·007	14·3	4·6
Other Companies.							
Kent	27·70	0·004	0·295	0·000	0·004	17·6	6 0
New River	20·70	0·030	0·135	0·000	0·004	13·7	3·3
East London	23·00	0·052	0·105	0·000	0·006	14·7	4·6

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours.

The water was found to be clear and nearly colourless in all cases.

C. MEYMOTT TIDY, M.B.

EXTENSION OF STOREAGE AT THE DOVER GAS-WORKS.—On Thursday, the 29th ult., the first brick of a new gasholder-tank at the Dover Gas Company's works at Buckland was laid by the Chairman of the Board of Directors—Mr. W. R. Mowll, J.P. The tank is intended for the reception of a telescopic gasholder, 82 feet in diameter and 24 feet deep.

SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY.

An Extraordinary Meeting of this Company was held at the Terminus Hotel, London Bridge, on Wednesday last—Capt. HEATHORN in the chair. The object of the meeting was to consider the scheme of amalgamation pending between the Company and the Surrey Consumers Gas Company.

The SECRETARY (Mr. George Livesey) having read the notice convening the meeting,

The CHAIRMAN said: This meeting, gentlemen, is summoned at the instance of the Board of Trade, who require the approval of the Shareholders before they will pass the scheme of amalgamation. I can assure you that the Directors have given the matter the most careful consideration, and have recommended it to the proprietors for adoption, because they believe it to be not only beneficial to the Company, but a necessity. As, from force of circumstances, amalgamations are inevitable, on this consideration your Directors preferred taking the lead in the South of London, instead of following; such alternative course compelling them to accept terms that would not be so good as they were able, under existing circumstances, to negotiate for the Company. The Secretary will now read the scheme, and I shall then have to move a resolution, when the Shareholders will have the opportunity of fully discussing the matter, and of asking any questions that may occur to them.

The SECRETARY then read the proposed scheme, which has already been published in the JOURNAL.

It was suggested by Mr. MUIR that the meeting should be adjourned until the Directors had forwarded a copy of the scheme to the Shareholders, and they had had time to consider its provisions. He subsequently moved a resolution to that effect, but eventually withdrew it, on appeal from the Chairman and several of the Shareholders.

The CHAIRMAN formally moved—"That the scheme of amalgamation between this Company and the Surrey Consumers Gas Company now submitted be hereby approved, subject to such modifications as may be necessary, and that the Directors are hereby authorized to take measures to carry this amalgamation into effect."

Mr. FOSTER (Deputy-Chairman) seconded the resolution. He said that the amalgamation scheme had been discussed for the last twelve months, and it now became necessary to take steps in order to complete the amalgamation by the 1st of July. From one or two remarks that had been made, he gathered that there was a desire to consider the question more fully. All he could say was that if the Shareholders had sufficient confidence in the Directors, there would be no necessity for adjourning the discussion of the question. Any delay would be injurious to the interests both of the Gas Companies and also of the Consumers.

In reply to Mr. Maltby,

The CHAIRMAN said that the present charge for gas by the Surrey Consumers Company was 3s. 9d. per 1000 feet, and it was proposed, when the Companies were united, to reduce this to 3s. 2d.

The SECRETARY explained that after twelve months the charge would be made uniform over the whole district.

The CHAIRMAN remarked that from the experience of former years it was probable there might be a further reduction in the price of gas.

Mr. MALTBY observed that the change would be more especially beneficial to the Surrey Consumers Company, who, he thought, would get the lion's share.

The SECRETARY: There was an opposite opinion expressed at the Surrey Consumers Company's meeting last week.

Mr. BLANKS said he did not wish to imply that he had no confidence in the Directors, but he thought it only fair that the Shareholders should have had more time to consider the scheme.

Mr. ABBOTT deprecated delay in the matter. The scheme, he said, had been made public in the columns of the JOURNAL OF GAS LIGHTING for several weeks. Apart, however, from all other considerations, the scheme was so obviously for the advantage of the Shareholders, that the Directors would never have entered into it if they had not seen the benefit that would accrue from it. It was advantageous to both Companies, more particularly to the South Metropolitan Company, looking to the physical boundaries of the two Companies.

[The SECRETARY then, by the aid of a map, pointed out the boundaries of the districts supplied by the two Companies, and expressed his opinion that the two districts, when united, would make one very compact whole.]

Mr. ABBOTT said that in the negotiations for the present scheme the Directors were following the precedent set by the Chartered Company, and he sincerely hoped that the scheme would be carried out. He had been acquainted with Gas Companies on both sides of the Thames for twenty years, and it was patent to any one who read the signs of the times that amalgamations would occur. If they did not take the lead, they would have to be driven; but he had always found it better to be in the van, and to have a voice in the direction of affairs. In point of fact, he thought that all interests would be served if the amalgamation were carried out, and he hoped that the motion intended to carry it into effect would be passed unanimously.

Mr. RILEY said he could not see what advantage would arise from delay, and thought it better to leave the whole matter in the hands of the Directors. In about twelve months the Company would reduce their price to the same figure throughout the whole district. He had no doubt that Mr. Livesey had taken into account the connection between the two Companies, and was convinced that the reduction in price would be accomplished in the time specified.

The SECRETARY said he had given his most serious attention to the point, and was persuaded that in twelve months gas in the Surrey Consumers district could be supplied at the price mentioned, without taking anything from the South Metropolitan.

Mr. ROSTRON (a Director) said he had taken great trouble in the compilation of the scheme, and the two clauses which he thought of most importance were clauses 29 and 30, which dealt with the capital and the dividends on the different classes of capital. Speaking for the Chairman and the Board generally, he should be glad to afford any information as to these clauses. He could not see what good would result in an adjournment of the meeting. He might state that the Directors had not acted on their own judgment, but had taken the advice of Mr. Hawksley, and he had confirmed the view that Mr. Livesey held as to the advantage to be derived from the amalgamation.

Mr. HARRISON asked if the present Board of Directors of the South Metropolitan Company, as well as the Engineer and Secretary, would remain permanently to manage the affairs of the United Company.

The CHAIRMAN said they would, with the addition of some other gentlemen from the Surrey Consumers Company.

Mr. JENKINS (another Director) said he observed that the meeting was in favour of amalgamation, and that being so, it would be a great pity to interfere with the obvious convenience of its being carried into effect after the 30th of this month. If the present meeting were adjourned, it would have the effect of postponing the consideration of the scheme by the Board of Trade, inasmuch as the whole matter lay in the two clauses to which reference had been made. There would, he thought, be no possible advantage from delay. The meeting was, no doubt, a small one; but a great many proxies had been sent in to be used as the Board thought proper.

He understood there was no actual opposition to the proposed amalgamation; and, if not, there should be no appearance of it.

The motion was then put, and carried unanimously.

A cordial vote of thanks was awarded to the Chairman and Directors, and was suitably acknowledged.

On the motion of Mr. HARRISON, seconded by Mr. BROWN, a vote of thanks was accorded to Mr. Livesey, the Secretary and Engineer, for his services in connection with the amalgamation scheme.

The CHAIRMAN, in supporting the motion, said that if all gas companies had officers of such intelligence, skill, and ability as Mr. Livesey, they would be equally prosperous with themselves.

Mr. LIVESEY, in response, said that he had given the scheme his most hearty support, and that he would never have countenanced it if he had not thought it was for the benefit of the South Metropolitan Company.

The proceedings then terminated.

CHRISTCHURCH (NEW ZEALAND) GAS COMPANY, LIMITED.

The Annual Meeting of this Company was held on Saturday, March 1—Mr. E. G. WRIGHT in the chair.

The SECRETARY (Mr. C. W. Bishop) read the notice convening the meeting, and the following report was presented:—

A statement of the accounts for the year ending the 31st of December last is herewith submitted, and the Directors have much pleasure in laying before you such satisfactory evidence of the progress of the Company.

Thirty-six additional public lights have been erected during the year, and the private consumption of gas has nearly doubled since 1876.

The increased demand for gas in the city and suburbs led your Directors to order the necessary materials for extending the mains to Opawa, Sydenham, the Ferry Road, St. Albans, Papanui, and Sunnyside, and they are now coming to hand; but since this order was given, the electric light has taken a new departure, and, pending more definite information as to how far it is likely to supersede coal gas, your Directors hesitate to carry out these extensions, and for the present have decided to stack the mains at the Company's yard. For the same reason, although specifications for a large gasholder have been sent to London, the order will not be executed until further instructions are given by telegram. At so critical a period the Directors cannot recommend a reduction in the price of gas.

The result of the past year's operations shows that after paying an interim dividend, and carrying £2200 to a reserve-fund, there remains a balance of £4786 1s. 6d., out of which the Directors recommend that £3960 be paid as a further dividend, and that the balance of £826 1s. 6d. be carried forward.

By the new rules it is necessary that any new candidates for the directory notify their intention in writing to the Secretary, three clear days before the annual meeting.

The retiring Directors are Messrs. John Anderson and H. J. Tancred, who offer themselves for re-election.

Dr.—*Balance-Sheet, Dec.* 31, 1878.

To Capital	£80,000	0	0
Debts due by the Company	518	2	11
Bills payable	3,526	1	8
Insurance-fund	194	18	0
Deposits at call	4,800	0	0
Unclaimed dividends	91	13	10
Reserve-fund	2,200	0	0
Balance	4,786	1	6
	£96,116	16	11

Cr.—*Balance-Sheet.*

By Property, land, and buildings	£5,868	5	3
Plant	47,443	7	6
Amount available by call	36,000	0	0
Office furniture	113	15	7
Shares in Investment and Loan Association	196	0	0
Funds invested on mortgage	1,700	0	0
Debts due to the Company	2,573	17	7
Stock on hand, coal, &c.	898	15	1
Stock on hand, gas-stoves	26	1	9
Cash at Bank, N. S. W.	1,135	3	1
Cash in hand	167	11	1
	£96,116	16	11

Dr.—*Revenue Account for the Year* 1878.

To Stock—						
Coal and purifying material, Jan. 1	£969	15	5			
Subsequent purchases of ditto	5,266	7	1			
	£6,236	2	6			
Less stock on hand, Dec. 31	898	15	1			
				£5,337	7	5
Wages—						
Carbonization	£1,033	2	0			
Purification	293	8	5			
Meter and other repairs	280	8	3			
Lamplighters, service-laying, and general work	892	18	10			
Salaries—						
Secretary and Manager, and Collectors commission, Directors fees, &c.	1,537	15	10			
Rent, taxes, and insurance	225	6	8			
Tools, materials, and renewal of retorts	249	4	4			
Stationery, advertising, and printing	87	3	0			
Miscellaneous	248	5	7			
				4,877	12	11
Discount and interest				1,935	3	9
Bad debt, marked off				80	2	9
Reserve-fund				2,200	0	0
Balance				7,476	17	7
				£21,907	4	5

Cr.—*Revenue Account.*

By Sale of gas and rent of meters				£19,531	14	9
Coke, tar, and sundries	£2,308	7	2			
Rents	58	10	0			
Transfer fees	8	12	6			
				2,375	9	8
				£21,907	4	5

The CHAIRMAN, in moving the adoption of the report and balance-sheet, said it would be seen from the former that the Directors were somewhat exercised in their minds as to what influence the electric light would have upon their extensions in the future. When the results of the experiments going on in London and elsewhere with the light were made known, they would be able to see how far it affected them. It had been said that the electric light could not be brought into household use because of the great cost; but it remained to be seen how far this would be borne out when Mr. Edison carried out the discoveries he was said to have lately made. The Directors would wait a reasonable time to allow of Edison's patent to be made known, and if, as he anticipated, the electric light should be found too costly for household use, they would then be justified in carrying out the large extensions projected.

Mr. G. GOULD seconded the motion, which was carried.

Mr. COWLISHAW moved—"That the Directors be authorized to pay a dividend in accordance with the recommendation contained in the report."

Mr. STEVENS seconded the motion, which was agreed to.

The retiring Directors (Messrs. J. Anderson and H. T. Tancred) and Auditors (Messrs. H. E. Alport and R. Walton) were re-elected.

The CHAIRMAN said that the honorarium to the Directors, which it was usual to move at these meetings, was provided for in the amended Articles of Association.

Mr. RUDDENKLAU asked whether the Directors intended to call up any more capital.

The CHAIRMAN said it had been decided that no more capital should be called up for at least six months, unless something extraordinary occurred. The Directors had no desire to call up capital sooner than stated.

Mr. RUDDENKLAU asked whether it was not possible to make the calls smaller—say 10s., instead of £1.

The CHAIRMAN said he had not heard any objection to the calls. He would desire to point out that the extensions the Directors proposed to carry out would involve an expenditure of at least £20,000. To do this they must either call up more capital, or issue debentures.

The meeting then terminated.

THE GAS SUPPLY OF NORWICH.

At the Quarterly Meeting of the Norwich Town Council, on Tuesday, the 27th ult.—the MAYOR (Mr. H. Bullard) in the chair—the Finance and Rating Committee reported that, acting under the resolution of the Council, they had applied, through the Town Clerk, to the Secretary of the British Gas Company, Limited, for the accounts of their Hull undertaking, and asked him for an explanation of the difference in the relative cost of the supply of gas in Hull and Norwich. The Town Clerk embodied what the Corporation required in writing, explaining that the resolution making the request was an amendment carried on a proposal made to accept the Company's offer to supply gas to the Asylum at 1s. per 1000 cubic feet beyond the price charged in the city, for a period of ten years. Mr. Linging, the Secretary of the Company, replied as follows:—

The British Gaslight Company, Limited.

Chief Office, No. 11, *George Yard, Lombard Street, London, E.C., May* 8, 1879.

Dear Sir,—I beg to acknowledge the receipt of your letter of the 23rd ult., on the discussions that have taken place at meetings of the Town Council on the subject of this Company's proposals to lay mains for the supply of gas to the new Asylum at Hellesdon, and stating that you are instructed by the Finance and Rating Committee to ask for abstracts of the capital and working accounts of the Hull undertaking for the past year or two, and also for an explanation of the great difference in the price of gas supplied by the Company at Hull and of that in Norwich.

In reply, I am desired to express the Board's surprise that such a request should be made, particularly as the Norwich station of the Company is governed by two Acts of Parliament of the years 1858 and 1875 respectively.

As the capitals and accounts of the two stations are separate and distinct, and the correctness of the Norwich accounts, even to a petty cash entry, being verified by your Auditor, the Norwich station cannot possibly have any relation with the Hull station of this Company. Therefore, your request for an abstract of the Hull accounts of this Company cannot be complied with.

I am to mention that in Hull there are three Companies, all under parliamentary powers, and occupying separate districts. They are Kingston-upon-Hull, Sutton and Drypool, and the British. The two former are local Companies having local influence and capital. The Kingston-upon-Hull Company, occupying a densely-populated district, charge 4s. per 1000 cubic feet. The Sutton and Drypool, also occupying a well-covered district, charge 4s. 6d. per 1000 cubic feet. The British charge 2s. 6d. per 1000 cubic feet.

With regard to the second portion of your request, for an explanation of the great difference in the price of gas supplied by this Company at Hull and that in Norwich, the Directors have no wish to withhold an explanation, but it is rendered purely as a matter of courtesy to the authorities, and not in compliance with any resolution passed at meetings of the Town Council. The reasons are as follow, viz.:—

The price of gas in Hull is 2s. 6d. per 1000 cubic feet net; in Norwich, 3s. 9d., with a scale of discounts to 3s. 4½d. per 1000 cubic feet.

The price of coal into store in Hull for the year 1878 was 11s. 10d. per ton. In Norwich, for the same period, it was 15s. 3d. per ton, and the coals carbonized in Norwich were 32,000 tons. The difference in cost of coal on an equal quantity carbonized at Hull would be 3s. 5d. per ton, or £5466 in favour of the Hull station.

The residual products of the coal in Hull realize a larger sum than they do at Norwich, Hull being a shipping port of considerable importance, while Norwich is an inland city.

The assessment in Norwich is excessive as compared with the assessment at Hull, and the rates in Hull are half the amount of the rates in Norwich, arising, it is assumed, from the fact that the Hull Corporation is free from debt and possesses property, while the Norwich Corporation is heavily burdened with debt, to the relief of which this Company, being assessed at £5250, the highest on the assessment list, as now shown, contributes very largely—viz., British Gas Company, £5250; Messrs. Colman, £4410; Water-Works, £3367; Great Eastern Railway, £3217; Messrs. Bullard, £1026.

The public lamps at Norwich are supplied at a very low rate, the price realized, after deducting the expenses for lighting, cleaning, repairing, &c., being only 2s. 10½d. per 1000 cubic feet. The consumers of gas in the suburbs of Norwich have been supplied with gas for the last 20 years at the same rate as those in the city, although the Company possess the power under the Acts of Parliament of charging 1s. extra per 1000 cubic feet in the suburban district.

The cost of gas coal in Norwich is large on account of the 35 miles of river freight from Yarmouth and Lowestoft; but the price of gas in Norwich will not compare unfavourably with the price of that supplied in neighbouring towns, as the following list will show:—

1. Colchester, 4s. 9d. per 1000 cubic feet.
2. Lowestoft, 4s. 9d. net per 1000 cubic feet.
3. Bury, 4s 7d. net per 1000 cubic feet.
4. Yarmouth, 3s. 9d., discounts up to 10 per cent.
5. Cambridge, 3s. 9d. net.
6. Norwich, 3s. 9d., discounts up to 10 per cent.
7. Ipswich, 3s. 6d., with discounts.

The same economy of management is exercised at Norwich as at Hull, and were the circumstances alike at each station, there would be no marked difference in the price of gas.

This Company has been connected with Norwich for upwards of half a century, and for the last 20 years it has been under the recent parliamentary restrictions, the whole of which have been honourably and faithfully observed. Its capital has been kept within the most economical limits, consistently with the efficient maintenance of the plant. The purity and the illuminating power of the gas supplied are under the inspection of your Chemical Adviser, and the accounts are subject to the minute scrutiny of your Auditor, who for 20 years has never had occasion to doubt their correctness. The price of gas is moderate, considering the cost of coal and the low value of residual products, and it has been recently voluntarily reduced, although, up to the present date, not one farthing of reserve-fund has been obtained, as the accounts, verified by your Auditor, will prove.

The Directors would feel obliged by this letter being published *in extenso* in the proceedings of the next meeting of the Town Council.

(Signed) FREDERIC LANE LINGING, Secretary.

Mr. DAWS, in moving that the report be received, said he regretted that the efforts of the Committee had been abortive. It was stated at the last meeting of the Council that 2s. 6d. per 1000 cubic feet was charged for gas in Hull, against 4s. in Norwich. When the Committee met, they inquired the quantity of gas annually consumed in Norwich, and found it was 200 million cubic feet, which at 1s. 6d. per 1000 amounted to £15,000. As the Committee could not understand why the same Company charged Norwich £15,000 more than Hull, they resolved to ask them to furnish the working accounts of the Hull station, and say what was the difference of the relative cost. But the Company had refused to do this. The letter gave the Corporation a slap in the face, when it told them (which was not a pleasant thing) that they were in debt, and that because Norwich was so heavily burdened the Company had to pay double the amount of rates they had to pay in Hull. But how much would the rate question help the Company? The £5250 at which they were assessed in Norwich was subject to a discount of 10 per cent., which reduced the amount to £4725. Rates on that at 9s. in the pound would be £2126, while the Company said that they only paid £1563 in Hull in rates. Then the difference in the price of coal, at 3s. 5d. per ton, came to £5466. These two items of rates and difference in the cost of coal amounted to £7029, which had to be set off against the £15,000 which Norwich was charged more than Hull. As to residuals,

coke sold at from 7s. 6d. to 9s. per chaldron in Norwich, against from 5s. to 6s. in Hull. Then though the Company complained of the Norwich rates, they were silent as to rent; for he apprehended that rent in Hull was higher than in Norwich, so that putting rent and rates together at each place there would be found to be very little difference. Further, labour was cheaper in Norwich than in Hull. It was an unfair statement in the letter that the charge made by one Company in Hull was 4s. 6d. per 1000 feet. That was true; but then it was for gas supplied outside, not inside the borough, where the charge was 4s. per 1000 feet. Though there were three Gas Companies in Hull there was no competition, as the Companies had a monopoly in their own districts. The Committee were powerless to proceed any further in the matter. The different positions of Hull and Norwich seemed to be owing to the Act of Parliament applying to the former place not allowing the Company to raise capital in the same way they had done in Norwich. In conclusion, he said that the only bright spot amid the mists of this gas question was the fact that the price had been reduced 3d. per 1000 feet.

On the motion of Mr. DAYNES, the further consideration of the letter was adjourned till the next meeting of the Council.

ULVERSTON LOCAL BOARD GAS-WORKS.

Mr. John Swan, the Manager of the Ulverston Local Board Gas and Water Works, has just presented his report, for the year ending the 31st of March last, on the operations in connection with the Gas Department. From this it appears that the total quantity of coal and cannel carbonized during the twelve months was 1542 tons 13 cwt.; and the quantity of gas manufactured during the same period was 15,752,900 cubic feet. The quantity of gas made during the year ending March 31, 1878, was 16,359,100 cubic feet. There was, therefore, last year a decrease of 606,200 cubic feet, or slightly under 3¾ per cent. The quantity of gas registered by the consumers meters during the twelve months ending March 31, 1879, was 12,950,210 cubic feet; the quantity sold for public lighting, 1,755,974 cubic feet—total, 14,706,184 cubic feet. The unaccounted-for gas, which includes that consumed on the works for the twelve months, was 1,046,716 cubic feet, or slightly under 6¾ per cent. This is very satisfactory, and is an improvement on the previous year, the amount then being 8½ per cent. The saving realized through the decrease in the unaccounted-for gas amounts to 275,673 cubic feet. This is principally due to the attention devoted to the mains and services, and the thorough periodical inspection of the meters. The average make of gas per ton of coal carbonized was 10,211 cubic feet, as compared with 9750 cubic feet in the previous year. For 1877, 9377 cubic feet; and for 1876, 9411 cubic feet. The maximum quantity of gas manufactured in any week last winter was 590,000 cubic feet, or an average of 84,257 cubic feet per day. The illuminating power of the gas during the year averaged 16¾ candles. The total length of mains added during the twelve months was 781 yards. The number of street-lamps is now 209, lighted with 116 burners, consuming 5 cubic feet per hour; and 93 consuming 3½ cubic feet per hour. The total number of meters in use is 822.

Appended to his report is the following working statement:—

Gas made, as per station-meter		15,752,900 cubic feet.
Gas sold to private consumers	12,950,210 cubic feet.	
Gas sold for public lighting	1,755,974 ,,	
	14,706,184¼	,,
Unaccounted for (or 6¾ per cent.)	1,046,716	,,

Coal carbonized—	Tons.	Cwt.
Common coal	1261	14
Cannel	280	19
	1542	13

Illuminating power required by Act	14 candles.
Illuminating power supplied	16¾ ,,
Gas made	15,752,900 cubic feet.
Gas made per ton	10,211 ,,
Gas sold	14,706,184 ,,
Gas sold per ton	9,533 ,,
Gas sold, per cent. on make	93·25 per cent.
Gas unaccounted for, including that consumed at the works	1,046,716 cubic feet.
Gas unaccounted for, per cent. on make	6·75 per cent.
Coke made	1000 tons.
Coke used for fuel	57·2 ,,
Coke used for fuel, per cent. on make	57 per cent.
Tar made, 119 tons, at 200 gallons per ton	23,800 gallons.
Tar made per ton of coals	15¼ ,,
Liquor made, 182 tons, at 230 gallons per ton	41,860 ,,
Liquor made per ton of coals	27 ,,

THE BIRMINGHAM CORPORATION AND THE RECENT GAS-WORKS ARBITRATION APPEAL.

A Meeting of the Birmingham Town Council was held last Tuesday—the MAYOR (Alderman Collings) presiding—when the Gas Committee reported—that the arguments on the rule *nisi* to set aside the award in the West Bromwich Gas-Works Arbitration case, or refer it back to the Umpire, were heard on the 22nd, 28th, and 29th of May, when the Court of Queen's Bench discharged the rule with costs. The Council would, the report stated, remember that the Gas Committee on the 10th of December last stated that the proceedings to endeavour to get the award set aside or referred back to the Umpire were undertaken on the strong advice of the Attorney-General, the Solicitor-General, Mr. Michael, Q.C., and other eminent counsel, and of Mr. Hawksley, and the Council were also then informed that the advice received from these gentlemen was of such a nature that made it the duty of the Committee to take proceedings. Since the decision of the Court of Queen's Bench was given, the Committee had been further advised by the same gentlemen to prosecute an appeal against the Court of Queen's Bench. The Committee had given very careful attention to the matter. They had arranged for a public conference with their counsel, and, having regard to the magnitude of the interests at stake, and to the fact that the cost of such further appeal would not be very considerable, they recommended that they be authorized to prosecute the same, if they were so advised at the ensuing conference.

Alderman CHAMBERLAIN, M.P., moved the adoption of the report. He said that it was impossible for him to go into details while the subject was, to a certain extent, under the consideration of the judges. It might, however, be well to recall the history of the matter. When the Corporation were before Parliament in the first instance, in their endeavour to obtain possession of the gas undertaking, certain of the Local Authorities, and especially the four which were now purchasing parts of the works, strongly opposed them. The Corporation did all in their power to remove and to conciliate the opposition, and again and again he offered them, on behalf of the Council, to share the bargain, stating that the Council would sell them their portions on exactly the same terms as they had bought them. All those efforts were unavailing. They could not agree, in the first instance, as to what were the terms on which the Corporation had bought the works, and, what was of still greater importance, the Local Authorities repudiated the idea that they were to pay the same proportion as the Corporation. They said that the Corporation had made a bad bargain, and that it was not fair that they should be forced to pay in the same proportion. Under those circumstances, when a suggestion was made in the Committee of the House of Lords that no attempt should be made to fix the value then, but that the whole question should be left to arbitration, he, on behalf of the Council, at once said that he would not consent to anything of the kind unless it were absolutely clear that the Corporation would not be prejudiced by any of their previous offers, and that the arbitration to be held should be an open arbitration. That was conceded by one, at all events, of the Local Authorities; and the clause which was drawn up to carry that arrangement into effect was declared by the Corporation counsel to be such as would guarantee an open arbitration. In justice to their counsel he must say that throughout they had maintained that the wording of the clause did necessitate an open arbitration, in which no reference ought to be made, or could legally or justifiably be made, to any previous proceedings or offers whatever. On the part of the Local Authorities it had been contended that it was not an open arbitration that was to be held, but one limited by the circumstances of the transfer of the property to the Corporation. They had altogether dropped the argument that the Corporation had made a bad bargain. On the contrary, they admitted that the bargain was a good one; but while in the first instance they said they were not to be committed to take the Corporation's bad bargain at the price the latter had given for it, they now refused altogether to take their good bargain at the price which it was worth. That had been throughout the contention between two sides, and it became evident, at an early period of the arbitration, that the Umpire, Sir Henry Hunt, was likely to lean rather to their opponents side than to that of the Corporation. They urged upon Sir Henry Hunt, in the strongest possible terms, that he should so state his award as that a case upon the legal question might be cheaply and conveniently raised in the law courts. The Gas Committee sought the assistance of the most eminent counsel. They consulted the Attorney-General, Mr. Chitty, the celebrated Chancery barrister, and another gentleman, who they found all took the same view as had been taken by Sir Edmund Beckett and Mr. Michael, their parliamentary counsel. Later on Mr. Hawksley, on his own account, consulted the Solicitor-General and two Chancery barristers, and obtained from them confirmation of the original opinion upon which the Gas Committee had acted. These opinions were brought to the knowledge of Sir Henry Hunt and his legal assessor, Mr. Wills; but when the award was published, it became apparent that they had not very materially influenced the judgment of those gentlemen. The valuation showed that the Umpire leaned very much to the view of the Local Authorities, and that he had been guided to the conclusion at which he had actually arrived by considerations connected with the price which the Corporation had paid for the property, and not by any considerations connected with what they claimed to be the real subject of the inquiry—namely, the actual value of the property at the time the Corporation had to surrender it. He might say, in passing, that he had seen the price which was set upon the property stated in the public prints to be the value attributed to it by himself, but neither the Gas Committee nor himself had ever publicly expressed any opinion whatever as to the value of the property which they had to sell. The matter had been entirely left to the professional gentlemen selected for their eminence and experience, and who had to give evidence upon oath, without any suggestion from the Committee as to what value they should fix. All he could say was that it was, of course, gratifying to find those gentlemen, after considering the matter independently, fixing a very high value upon the property—a value which represented something considerably greater than they had given for the whole undertaking. The award being, as he had explained, evidently based upon a construction of the Act of Parliament different from that which the Committee had always contended for, they again took the opinion of the counsel who had been consulted at different times, and they were unanimously and strongly of opinion that the Umpire had been mistaken in his legal construction of the Act. They therefore urged upon the Corporation to appeal to the Court of Queen's Bench. He did not think he ought to say anything in reference to the judgment, which, of course, was a disappointment, except that it was perfectly evident to those who were in court that the Lord Chief Justice took a view antagonistic to the Corporation upon hearing counsel on the other side, and before hearing a word from the Corporation advocates. The decision was entirely against them, and they had now to consider whether they should carry that most unsatisfactory, anxious, and expensive litigation further. Counsel met again after the hearing, and they were again unanimously and strongly of opinion that they ought to carry the matter one step further to the Court of Appeal, where they would have the advantage of the learning of three judges, and where they should take what he thought in any case they should receive as the final award. Counsel informed them that the expense of going to the Court of Appeal was comparatively small. The sum at stake, although they could not put any figure to it, was necessarily very considerable; and they had, therefore, to consider whether, in justice to the ratepayers, for whom they were trustees, they could refuse to take the further trouble and anxiety involved, if the expenditure it would entail upon them might result in a considerable increase in the sum which had been already awarded. The point at issue was clearly a legal one, and the responsibility of which they entirely threw upon their legal advisers. They were men of the greatest eminence in their profession, and he really did not see how they could, with any propriety, refuse to be guided by their advice. It would be a great relief to the Committee if the Council were to say they had gone far enough; but, on the considerations he had stated, the Committee recommended that if, on further conference, counsel should be again unanimous that they should appeal, the Council should authorize the expenditure of the money necessary to take the final judgment in the matter.

Alderman BIGGS said every one knew that when the Corporation obtained possession of the concern it was in a very different position to what it is now. The works, since they had become their property, had increased in value by the expenditure of both time and labour, and some compensation should be given for the time and money which had been so expended. There was a question raised in the decision of the Lord Chief Justice, which was a very important one—viz., the power of the Corporation to make a profit out of the transactions of the Gas Committee. He hoped that at the consultation with counsel steps would be taken to elicit their opinion as to the position of the Corporation, and whether they would be justified in still carrying on the business and making a profit.

Mr. BEARD said he hoped the Council would not consent to any further expenditure with a view of carrying on the litigation between Birmingham and the outside Authorities. He was sure they would gain nothing by it. The Lord Chief Justice had referred to particular clauses in the Corporation Act, and had stated distinctly that they could not make a profit, and he felt convinced himself that they would not gain anything by having a further inquiry before the Court of Appeal.

After some further discussion,

Alderman CHAMBERLAIN, in reply, said: We have, on the one hand, the expression of opinion of Mr. Beard—I do not say for a moment he is not right—and we have, on the other hand, the strong advice of legal gentlemen, and it is for the Council to say which of these two advices they will

take. We do not pretend to be very sanguine in this matter. We have been disappointed hitherto. We ourselves have no opinion which is worth having. It is a subject beyond and outside our knowledge; it is a special subject of law, and we are much less sanguine over it, owing to our having been so frequently disappointed in the past; but having regard to the strong expression of opinion to which I have already referred, we do not see how we can perform our duty to the ratepayers without taking an opinion which will justify us in abandoning further prosecution of the matter. Alderman Biggs referred to a passage in the judgment of the Lord Chief Justice, who said that in his opinion corporations having water-works and gas-works were not intended by Parliament to make any profit by them. Well, I do not presume, of course, to criticize the opinion of the Lord Chief Justice. I do not know how many, but probably nearly a hundred corporations are in the same position as the Corporation of Birmingham, having gas-works and water-works, and who have taken their gas-works for the sole purpose of making profit and carrying such profit to the borough fund. I can only say our own Act of Parliament contains a number of clauses which state the way in which we shall deal with the profits which we make. It is a curious thing, if it was not intended we should make a profit, that Parliament should have gone to such pains in drawing up a series of elaborate clauses describing the way in which we shall deal with the profit. I think the Lord Chief Justice has much greater knowledge of law than of the practice of corporations.

The resolution was then put and carried—44 voting for it, 1 against it, and 6 remaining neutral.

WEST OF SCOTLAND GAS MANAGERS ASSOCIATION.

(*Continued from page* 766.)

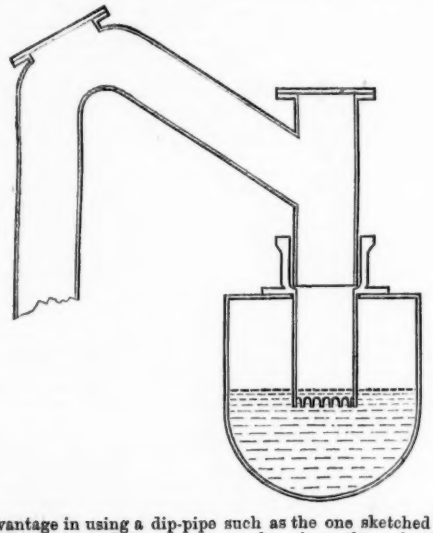
Mr. Robert Mitchell (Coatbridge) read the following paper:—

ON THE PULSATIONS ON THE RETORT.

At a recent meeting, many of us present were privileged to listen to our much-esteemed member, Mr. Young, deliver a most instructive and highly scientific address on "Some of the Physico-Chemical Laws relating to the Manufacture of Gas." The first subject treated was the deposit of carbon on the interior of the retort. The theory then propounded was to me very interesting, and had the effect of arousing in me a feeling that a new line of thought had been opened, which investigation with experiment alone could determine. As I look upon our Association as one for mutual improvement and interchange of opinion, I venture to bring the matter before you, trusting that many members may, in their spare moments during the winter, have been thinking over, and perhaps experimenting on this important subject, and, if any one has formed a wrong idea, it may be brought out in discussion.

Mr. Young, in his paper, showed, by experiment, the diffusion of gases through porous septa, and then the oscillatory action of the gases in the retort. There was shown a diagram of dip-pipe which had for its object the breaking up of the gases, and also the prevention of the pulsations inside the retort. The arrangement was very beautiful, but to me it had the disadvantage of requiring the tap to be opened or shut as the passage of the gas from the charges necessitated. To overcome the pressure and the pulsations by some simple means has since been my endeavour.

While in conversation with one of the members, on the influence of the pulsatory action on the retort, he remarked that he had observed the reduction of pressure, and also the absence of pulsatory action, when air or gas was passed through a rose-ended pipe compared with an open square-cut end. I immediately set about an experiment on this. The rose end had this objection—its liability to clog. I tried various shapes of openings in half-closed ends and in the sides of the dip-pipes; but found the



greatest advantage in using a dip-pipe such as the one sketched here. I have adopted this method in my new works, where the pulsations and pressure on the retorts are reduced to the lowest minimum; so that it is scarcely perceptible on the gauge, and the sound in the hydraulic main can only be heard with difficulty, although there are three ovens of five retorts at work.

As to the advantages to accrue from this change, I can as yet say very little. I have only had the bench at work something like six weeks, and although the pulsatory action has been reduced, still the carbon on one or two retorts continues to form, while the others are practically as clean as the day they were set; so that I am now of opinion that there must be some other cause at work in this formation. In one retort the carbon is in a narrow stripe; in another, it forms a broad flat surface. There must be chemical action or affinity brought into play at certain places and under certain circumstances, as clearly shown by the manner in which the carbon is deposited. Whether or not I have been able to make any headway in the overcoming of this troublesome deposit, time alone will tell. If the relieving of the pulsatory action is of no advantage, we are not in a worse position than when working under the old system.

Mr. Hall: As far as pulsation is concerned, I have made experiments on the retort-bench. One way I adopted by which I relieved the pulsation considerably was by taking the bottom of the dip-pipe in the hydraulic main, and instead of having it to strike straight, I put notches round the bottom of the dip, and the result is that the beat at my hydraulic main is almost silent. But that can only be done where you are certain there is no heaving of the main so that the seal may be carried away. Where mains rest on the bench, it requires great caution; but you can relieve the pulsation by notching the pipe. By adopting this method, I could work with no more than half an inch of seal on the bearing part of the pipe. It worked with perfect safety, and besides gave a greater yield of gas, and relieved the pressure on the retorts. So far as the carbon of the retort is concerned, that depends on the action of the fire.

Mr. M'Gilchrist: I think I am right when I say that there is no other part of the apparatus or plant of a gas-works that has been subjected to so much discussion as the dip-pipe. To-day we have had another phase of it. We have had it brought before us in every conceivable way; but I think from the date of its introduction, little or no improvement has been made on the old form of pipe. Certainly, in past times we used to work with three or four inches of pressure; but now it has been clearly proved that one inch is quite sufficient. I have yet to learn that there is any better form than the old one, with the inch of seal in liquid, but not in tar. I may state that I have visited the Coatbridge works, and examined the retort-bench, and, certainly, if the absence of pulsation is of any consequence in the manufacture of gas, the arrangement shown by Mr. Mitchell is perfect. With regard to the formation of carbon in retorts, I work at the present time with not more than an inch of seal, without any scolloped arrangement, but I take care that the pipe is always sealed in ammoniacal liquor or water, and I have little or no trouble with carbon deposits. I scrape the retorts every fortnight for the first four or five months, and after that I am never troubled to any serious extent. I think I can point to a reason why Mr. Mitchell's retorts show carbon at certain places. I think where two parts of the retort are joined together, they are more porous at the divisions than at any of the other parts, and it is the diffusion of gas between these divisions that causes the formation of carbon. I think Mr. Mitchell has misunderstood Mr. Young in regard to carbon deposit, as I think he modified his ideas in regard to the cause of that deposit. He stated to a meeting that the pulsations were the true cause of the formation of carbon; but, in the six months succeeding that time, he had discovered they were not the principal cause, but that the carbon deposit was really produced by the diffusion of the gas out and in through the porous clay of the retort. I think he has had no reason to alter his opinion since that time. From the frequent intercourse I have had with Mr. Young, I may state that it is still his opinion that this is the reason for the formation of carbon in the retorts.

Mr. Renfrew (Langbank): Two years ago I put in a retort, and after working for two or three days, the main became unseated, owing to the expansion of the bench, and this unsealed the dips. I then raised the water to half an inch of seal, and I do not think I had an inch of carbon on the retorts during the whole season. In my opinion, therefore, it is merely a matter of dip. I do not think I have half an inch of dip at the present time, and I am working splendidly.

Mr. Dalziel: I think it is a good idea that Mr. Mitchell has brought forward. At the same time, I am of opinion that there is a great deal in the retort itself. In a smooth retort the carbon does not grow so quickly as in the one that is rough. Much, too, depends on the man drawing. If the man is careless in drawing, it is astonishing how quickly the carbon gathers; but I think, in connection with a case of this kind, it is clear that this arrangement will assist in keeping down the carbon in the retort.

Mr. Mitchell: I find that I have ½-inch pressure on the seal, and I think it is quite sufficient, although it may be a little too much in the opinion of some members. Mr. Hall finds that his bottom retorts always keep clear of carbon when the others get coated. In my case it is the reverse. The three top retorts in my set are practically as clean as when they left the works, and the two under ones are beginning to have a coat of carbon.

A Member: Is it the same coal that you always use in these retorts?

Mr. Mitchell: I work with four mixtures representing seven coals, and they just take their turn, and the whole charges are equalized.

The President: Would not the use of the different varieties of coal produce those different results?

Mr. Mitchell: It cannot be so in my case, because they are all charged from the same barrow in rotation.

In answer to another question, Mr. Mitchell said the retorts were all of the same size.

Mr. M'Gilchrist: There is some difference between Mr. Hall's experience and Mr. Mitchell's. In the one case the extreme heats may heat at the bottom, and in the other at the top. No doubt the heat has a great deal to do with the formation of carbon. With high heats you decompose the gas, and consequently there is a deposit of carbon.

Mr. Hall: It is at the point at the top of the retorts, where we have the return of flame, that the deposit of carbon takes place. In my retorts I may say you can scarcely detect which of the retorts has the heats—there is a very uniform heat over the whole of them.

The President: We have had this subject brought forward again, and talked over. I think we are very much of one mind, that the deposit of carbon is not entirely due to the heats, but also to the characteristics of the retorts. If we have light heats and smooth retorts we shall not have so much carbon. At the time of the introduction of exhausters, it was found that by relieving the pressure the deposit of carbon was considerably reduced; thus showing that pressure has something to do with the deposit of carbon, due, no doubt, to the retention of the gas in the highly-heated retorts, where it is broken up into its elementary constituents.

A vote of thanks was then accorded to Mr. Mitchell for his paper.

Miscellaneous Business.

A communication from Mr. Menzies, of Lerwick, as to his method of sealing retort-lids, was read, and, on the suggestion of the President, a discussion of the system was held over.

Mr. A. Donaldson and Mr. Paterson, of Edinburgh, exhibited one of Mr. W. Cowan's newly-invented "Automatic Pressure Regulators," and explained its working. The instrument shown is intended for use with a 24-inch governor at one of the Phœnix Gas Company's works.

Mr. D. M. Nelson, of Glasgow, also exhibited a 200-candle Sugg burner. He stated that with Scotch gas of 26 or 27 candles such a burner, it was computed, gave an illuminating power equal to 350 to 360 candles.

The Next Meeting.

On the motion of Mr. M'Gilchrist, it was resolved to hold the next meeting of the Association at Bridge of Allan.

An Office for the Association in Glasgow.

The Secretary was instructed to look out for a suitable room in Glasgow wherein the Committee could hold their meetings, and where papers connected with the Association could be preserved.

Proposed Amalgamation of the Association and the North British Association of Gas Managers.

The President said that the other matter which claimed attention that day was a letter addressed to him by Mr. Alexander Smith, of Aberdeen, the President of the North British Association of Gas Managers, in which the

idea of amalgamating the two Associations was mooted. He (the President) stated that this was a matter which had come altogether from Mr. Smith. It did not come from his side, and as the members had done him the honour of electing him President, he did not think it would become him to be a party to the absorption of the Association in another. Therefore he would not think of encouraging the amalgamation, especially so long as he was President; and as an honorary member he scarcely thought it right to interfere. He considered the district Associations were of great value, and the success of this Association had shown the advantages of frequent meetings of managers in their own districts. Still, there was nothing to prevent union. There could be a central Association and district Associations, all members of which would also be members of the main Association. And then, instead of having two days meetings, the main Association could remit questions to district Associations, or matters could come up from the district Associations for discussion at the main Association. In connection with this Association, however, there was a Benevolent Fund, and an organization which could not readily be given up without doing injustice to certain persons. What he wanted the members to do was to take this matter into consideration. The Committee were not inclined to bring the matter forward in a formal way, and as it would be unfair to refer the question to a Committee or to a single individual, it must be remitted to the whole of the members, who would afterwards discuss the question.

After some few remarks from members present, it was agreed to leave the question in the hands of the Committee.

CARBURETTING AIR.

In the JOURNAL for April 29, page 646, we reprinted from *Engineering* a letter on the above subject. The following in reference to it has since appeared in the same periodical:—

To the Editor of "*Engineering*."

Sir,—An interesting letter on this subject, signed William Lyon, has lately appeared in your journal. As, however, it contains some statements which I cannot understand, I would wish to call the writer's attention to apparent discrepancies, which, perhaps, he may clear away.

1. Mr. Lyon states that by passing 1000 cubic feet of atmospheric air at 56° through gasoline (sp. gr. ·655) he obtained 1320 cubic feet of carburetted air of sp. gr. 1·396, and that the air absorbed 16 gallons of gasoline. Now, at temperature 56° Fahr., 12·98 cubic feet of air weigh 1 lb., consequently 1000 cubic feet weigh $\frac{1000}{12{\cdot}98} = 77{\cdot}04$ lbs., and 16 gallons of gasoline weighing 6·55 lbs. per gallon = 104·8 lbs. The weight of materials therefore = 77·04 + 104·8 = 181·84 lbs. On the other hand, 1320 cubic feet of carburetted air of sp. gr. 1·396 weigh 77·04 × 1·320 × 1·396 = 141·96. There is, therefore, a difference between the materials and the products of 181·84 − 141·96 = 39·88 lbs.

2. Mr. Lyon states that by the expenditure of 12·7 gallons of gasoline, he converted 1000 cubic feet of coal gas of sp. gr. ·434 into 1270 cubic feet of carburetted gas of sp. gr. 1·045. Now, at 56° Fahr. 1000 cubic feet of such coal gas weigh 33·43 lbs., and 12·7 gallons of gasoline weigh 83·18 lbs., the weight of the materials therefore = 33·43 + 83·18 = 116·61 lbs. On the other hand, 1270 cubic feet of carburetted gas of 1·045 gravity weigh 77·04 × 1·270 × 1·045 = 102·23, being 14·38 lbs. less than the materials employed.

There is, therefore, a mistake somewhere, and from the nature of the case, it is most likely to have occurred in estimating the specific gravities by Schilling's test.

In the usual way of testing illuminating power, the number of candles burning 120 grains of sperm per hour is compared with a burner using 5 cubic feet of gas. Each candle power, therefore, means $\frac{120}{5} = 24$ grains of sperm for each cubic foot of gas. We can, therefore, easily compare the illuminating and commercial values of common gas, carburetted gas, and carburetted air. The equivalents in pounds of sperm are as follows:—

$$\text{A. Coal gas} \ldots = \frac{1000 \text{ cubic feet} \times 17{\cdot}1 \text{ candles} \times 24 \text{ grains}}{7000 \text{ grains}} = 58{\cdot}63 \text{ lbs. of sperm.}$$

$$\text{B. Carburetted gas} = \frac{1270 \text{ cubic feet} \times 33{\cdot}83 \text{ candles} \times 24 \text{ grains}}{7000 \text{ grains}} = 169{\cdot}08 \text{ lbs. of sperm.}$$

$$\text{C. Carburetted air} = \frac{1320 \text{ cubic feet} \times 23{\cdot}7 \text{ candles} \times 24 \text{ grains}}{7000 \text{ grains}} = 107{\cdot}27 \text{ lbs. of sperm.}$$

D. Increase value of gas by carburetting C − A = 48·64 lbs. of sperm.

With gas at 4s. per 1000, and gasoline at 2s. per gallon, the cost of each is as under:—

A. 1000 feet of common gas at 4s.	4s.	0d.
B. 1000 feet of gas at 4s., and 12·7 gallons of gasoline at 2s.	29	5
C. 16 gallons of gasoline at 2s.	32	0
D. Improvement of coal gas, 12·7 gallons of gasoline at 2s.	25	5

And the cost of their equivalent of 1 lb. of sperm is—

A. Coal gas . . . . $\frac{48\text{d.}}{58{\cdot}63} = 0{\cdot}81\text{d.}$ = coal gas at 4s. per 1000.

B. Carburetted gas . $\frac{353\text{d.}}{169{\cdot}08} = 2{\cdot}09\text{d.}$ = coal gas at 10s. 4d. per 1000.

C. Carburetted air . $\frac{384\text{d.}}{107{\cdot}27} = 3{\cdot}57\text{d.}$ = coal gas at 17s. 8d. per 1000.

D. Improvement of gas $\frac{305\text{d.}}{48{\cdot}63} = 6{\cdot}27\text{d.}$ = coal gas at 31s. per 1000.

It is thus shown that carburetted gas for equal quantities of light is more than 150 per cent. dearer than common gas, while carburetted air is over 340 per cent. dearer, while the increased value given to the gas by carburetting it cost nearly eight times as much as the gas itself. If the comparison were made with cannel gas, the contrast would be still more striking in favour of the gaseous as compared with the liquid hydrocarbons. It is clear that the most wasteful way of using the light hydrocarbons is to employ them for the improvement of ordinary coal gas.

(Signed) DENNY LANE.

72, *South Mall, Cork, May* 1, 1879.

EXHIBITION OF GAS APPLIANCES AT NEWCASTLE.—On Friday, the 30th ult., an exhibition of gas-cooking stoves, heating apparatus, and burners was opened by the Mayor (Alderman Robinson), in the Central Exchange Art Gallery, Newcastle, in presence of a large attendance of visitors. The exhibition has been got up by the Proprietors, Messrs. Barkas and Tweedy, with the view of showing the various uses to which gas may be applied, and it will remain open until the 14th inst.

THE MUNICIPAL GAS-WORKS AT BRUSSELS.

As the forthcoming meeting of the Société Technique de l'Industrie du Gaz en France—the French Association of Gas Managers—is to be held at Lille in the course of the present month, it is proposed by the Committee that a visit should be paid by the members to the Municipal Gas-Works at Brussels. With the view of adding to the interest that will naturally attach to an inspection of gas manufacturing appliances of such importance as those at Brussels must be, and at the same time rendering the visit more practically useful to the members of the Society, the *Journal des Usines à Gaz* publishes a full description of the works, from which the following particulars are extracted:—

The Brussels Municipal Gas-Works occupy a plot of ground some 20 acres in extent, situated at Laeken, between the Willebroeck Canal, the River Senne, and the Belgian State and Dendre and Waes Railways. It will thus be seen that such a position as this leaves nothing to be desired on the score of convenience for the transport of material. The coals are brought to the works either by water or by rail, and a special locomotive is kept for the purpose of drawing into the works the trucks upon which are loaded the coals that are brought by water; those arriving by rail being shunted off the main line at the Schaerbeek Station. The same means are employed for the conveyance of the other materials used upon the works, as well as for sending away the various residual products.

The works are divided into two distinct sections—one for the distillation of the coal, and the other for the purification of the gas; the manufacturing operations connected with each section being carried on in large buildings specially appropriated to them. The first of these consists of the retort-houses and coal stores; the second, the purifying-house, the revivifying shed, and the buildings containing the exhausters, station-meters, governors, &c.

The retort-houses are four in number, each being about 200 feet long by 65 feet wide. The coal stores are placed between the retort-houses, and therefore are conveniently located for the supply of the ovens. Lines of rails connected with the principal lines on the works run from end to end of the retort-houses, while a transverse line, passing between the retort stacks, traverses the entire length of the building, and is connected by means of turn-tables with the lines just referred to. A separate line of rails, also connected with the others by means of turn-tables, serves for the removal of the coke and tar.

Each retort-house contains four stacks of retorts, set back to back, each stack consisting of eight ovens having seven retorts. These are 10 feet in length, and about 2 ft. by 14 in. in section, giving a capacity of about 24 cubic feet, which allows of a distillation of 13¾ cwt. of coal per 24 hours, in five charges of 2¾ cwt. each.

The production of each retort, with coal of good quality, is from 7000 to 8000 cubic feet per 24 hours. A setting of seven retorts, therefore, yields from 50,000 to 55,000 cubic feet of gas per day with about five tons of coal, or rather over 1000 feet for every 2 cwt. of coal distilled. The total number of retorts actually set being 896, the full productive power of the ovens is rather over 6¼ million cubic feet per 24 hours—a figure which exceeds by about 60 per cent. the maximum daily consumption. Space has been reserved on the works for the erection of two additional retort-houses, which will allow of the daily make being increased to about 9¼ million cubic feet.

The ovens are well constructed, and work with hot air. The amount of combustible employed for heating them is estimated at about 18½ per cent. The settings being placed back to back, a single chimney suffices for the two ovens. The height of the chimneys is 20 feet above the furnaces, and their sectional area is about 4½ square feet for the two ovens. The fire-bars have a superficial area of 3¾ square feet per oven. The ascension-pipes are 6 inches in interior diameter, and the width of the hydraulic mains is 2 ft. 6 in.

On leaving the hydraulic main, the gas traverses a series of condensing-pipes ranged along the interior walls of the retort-houses and coal stores. This arrangement allows of a better regulation of the temperature at which the operation of condensing is carried on. These pipes have a diameter of 1 ft. 4 in., and are 425 feet in length, which gives a condensing surface of about 550 feet for each block of 16 ovens. These are each provided with a collector 2 feet in diameter and 115 feet long, and two scrubbers, 7 ft. 6 in. in diameter by 35 feet high.

The 16 scrubbers in the distillation-house are connected with a large central scrubber 100 feet high and 20 feet in diameter. This gigantic apparatus has a working capacity of 20,000 cubic feet, which gives about 6 cubic feet of scrubbing surface per 1000 feet of the maximum day consumption.

Passing to the purifying-house, we come first of all to the exhausters. Of these there are two, each being provided with a 26-horse power engine, and being capable of exhausting about 6 million cubic feet of gas in the 24 hours. One of Körting's steam-jet exhausters, having a working power of 2¼ million cubic feet per diem, has been erected as an auxiliary apparatus for use in cases of emergency. It will thus be seen that the exhausters have been furnished equal to the total productive power of the ovens, which, as has been already stated, is about 60 per cent. in excess of present requirements. The speed of the exhausters is regulated by a clockwork arrangement of an extremely sensitive character. Its working is controlled by an electric alarum pressure-gauge, which gives warning whenever the slightest irregularity occurs in the speed at which the exhausters are running.

The purification of the gas is effected by means of oxide of iron. There are 24 purifiers, ranged in two rows, and they measure 10 feet by 20 feet, giving a superficial area of 200 square feet. The entire purifying surface, therefore, is very nearly 5000 square feet, which is equivalent to about 8 feet of purifier surface per 1000 feet of gas produced in the 24 hours. Each purifier consists of a double box—one fixed, similar to those ordinarily in use, and the other moveable by means of a steam crane. This arrangement allows of the purifying material being readily changed, and therefore very greatly increases the utility of the purifier.

The purifying-house is well situated between the lines of railway, which convey the purifying materials to the spot where they will be required. These are spread out in sheds extending the entire length of the revivifying-house. The fresh material, or that which has been revivified, is mechanically removed into two reservoirs, where it is stored. Two travelling cranes, moving from one end of the house to the other, suffice for all the purifiers. These cranes are worked by two steam-engines—one a compound, the other one of Brotherhood's three-cylinder engines—which likewise supply the motive power to all the appliances connected with the purification of the gas. The engines are driven by one of Naeyer's boilers; that working the exhausters being driven by three Galloway boilers with a single furnace.

By the side of the engines in the revivifying-house there is the repairing-house; in the opposite corner, by the side of the purifying-house, is the laboratory.

Outside the building, at a point about its centre, stands the meter and governor-house. Herein are three station-meters, each of which makes 80 revolutions per hour, and is capable of registering 1½ million cubic feet of gas.

The governor is one of Giroud's, and is placed upon the outlet-main, which is 2 ft. 9 in. in diameter. Gas is conveyed to it by means of a small pipe starting from the Place de l'Hôtel de Ville in Brussels, in order to ensure the maintenance of a constant pressure in the central part of the city. A regulator is likewise about to be placed on the second outlet-main, which is 2 feet in diameter.

From the station-meter the gas passes into four gasholders, three of which are 118 feet in diameter, and have a capacity of about 350,000 cubic feet each, the remaining one being 165 feet in diameter, and of 775,000 cubic feet capacity. The total capacity of the gasholders is therefore close upon 1,850,000 cubic feet, or about one-half of the maximum consumption in the 14 hours. Space has been reserved for the erection of three additional gasholders, in view of the future extension of the gas supply. The crowns of the gasholders are provided with special arrangements which allow of a variation being made in the weight.

The inlet and outlet mains are on a principle specially devised by M. Somzée, the Engineer of the works.

In addition to the buildings already described, there is upon the works an erection in which the tar and ammoniacal liquor are treated, and near the entrance gates are located the offices and workshops.

As the main intercepting sewer of the city passes under the gas-works, an attempt has been made to render the retort-ovens useful in the destruction of any mephitic gases that may arise, and for this purpose a subterranean channel has been constructed, which establishes a communication between the sewer and a series of flues opening beneath the retorts.

The system of canalization is not one of the least interesting portions of M. Somzée's work. There are, as we have said, two outlet-mains—one 2 ft. 9 in. in diameter, intended for the supply of the lower and central portions of the city; the other 2 feet in diameter, intended for the supply of the higher portions. These mains run from the works to the Allée Verte, where they join the system of mains intended for the supply of the city. The distance is rather under two miles. The mains are all jointed on a plan devised by M. Somzée, and they appear to have been mostly laid of a capacity sufficient to meet the requirements of a consumption 50 to 60 per cent. above present demands.

In the organization of the Brussels works, M. Somzée has been desirous of bringing electricity into the service. Electric alarum pressure-gauges are placed in the retort, purifying, and engine houses, as well as in the offices. Telegraphic communication is established between the different parts of the works, which are likewise connected by wires with the Hôtel de Ville, the six police offices, the fire brigade stations, and other places of importance in the city.

It will have been seen, from the foregoing brief description of these works, that the operations carried on therein must of necessity be of considerable extent. This will be further manifest by the following summary of the working account for the year ending Dec. 31, 1878. In that year there was expended on coals, purifying materials, repair and maintenance of plant, &c., and salaries, the sum of £82,746, and the year's working produced a revenue of £130,277; showing a balance of £47,531. Out of this sum, £14,845 was expended on improvements, leaving £32,686 clear profit. Out of the 595 million cubic feet of gas produced during the year, 430 millions were sold to private consumers, 91 millions were supplied to the public lamps, 3½ millions used on the works, and the remainder, 70½ millions, or nearly 12 per cent. of the total make—with the exception of about half a million feet in the gasholders—was unaccounted for.

The Directors report, which accompanies the accounts, states that the amount of gas sold during the year 1878 exceeded that sold in the preceding years by about 25 million cubic feet, being an advance of 6·4 per cent. The day consumption had increased, owing probably to the more extended use of gas for culinary, heating, and industrial purposes; 25 gas-engines having been fitted up in Brussels during the year under review. These engines are estimated to consume something like 5½ million cubic feet of gas per annum.

The consumption of gas in the public lamps had been reduced from 7 cubic feet per lamp per hour—the quantity fixed in the preceding year as the basis of the estimate—to 6 feet. The amount of gas consumed was, therefore, less, notwithstanding an increase in the number of lamps. This saving arose from a better regulation of the pressure, and the removal of the old burners, and the substitution of others furnishing a better light with a smaller consumption of gas.

The decrease in the unaccounted-for gas, as well as in that used in the public lamps—amounting together to about 77½ million cubic feet—explained how the works were able to meet the increase in the private consumption, while producing nearly 50 million cubic feet of gas less than in the year 1877.

Great improvements had been effected in the regulation of the pressure over the city, owing to the employment of suitable regulators. In the lower portions the pressure is kept at about 13-10ths, or nearly double that imposed upon the Paris Gas Company by the Municipality—8-10ths only being the pressure prescribed by them. Outside the Hôtel de Ville in Brussels a pressure-gauge has been fixed; consequently the public are enabled at any time to satisfy themselves as to the pressure.

Of course, complaints are occasionally made of a defective supply of gas. These arise partly from inadequate service-pipes and partly from defective meters. Whatever may be the cause, however, no time is lost in providing a remedy; and in order to enable consumers to better understand the requirements of efficient gas lighting, a paper of instructions as to fittings, burners, meters, &c., has been issued by the Directors. It is also their intention to open a small show-room, in which will be displayed specimens of the most approved gas lighting and heating appliances, and to afford such information relating to their use as may be interesting and instructive to the public generally.

EXTINGUISHING FIRES IN TAR DISTILLERIES, ETC.

In connection with the chapters on the Treatment of Residual Products, which have been published in the "Treatise" in the JOURNAL, during this year, the following, which recently appeared in the *Chemical News*, from the pen of Mr. Watson Smith, F.C.S., F.I.C., may be of interest to our readers:—

It may not be known to all tar distillers that in cases of fire in their premises their best remedy usually lies close at hand, and this I will shortly endeavour to demonstrate from a basis of experience and fact. In the first place, however, it may be well to state that as a rule the tar distiller cannot get any fire insurance company to insure him, and it will, therefore, be seen that it is a matter of no light importance to be possessed of a ready and efficacious method of subduing the dread element, when it breaks out beyond its due bounds. This remedy lies in the crude ammonia water, otherwise known as gas liquor, which almost every distiller works up conjointly with the tar, and if in some cases this be not so, it would be little incumbrance, and well worth while to obtain and keep a stock of, say, 1000 gallons of this gas liquor. The way in which I first became aware of the eminent extinguishing powers of gas liquor (now several years ago) is as follows:—A quantity of pitch was being run from a tar-still into the pitch-house, in which it is allowed to stand for some hours, to allow most of the noisome vapours to condense. By some means a flame came in contact with the vapours, an explosion occurred, and in a moment the roof was blown off, and the whole mass of molten pitch ablaze. Water, though thrown on in quantity, seemed to avail nothing, and at last the supply accidentally ran short. Almost in despair the pumps for raising the gas liquor into the ammonia stills were adjusted so as to deliver a jet of the liquor upon the fiercely burning pitch; the expedient acted like a charm, and the fire was quickly smothered.

I think there is considerable probability that at the high temperatures attained in some fires even the ammonia itself would be decomposed, with liberation of nitrogen and hydrogen gases, which, in addition to the volumes of carbon dioxide and steam, choke out the flame by simple displacement of air. It might be said that if hydrogen and nitrogen be so liberated together, these, together with the H_2S also set free, would do much to neutralize the effect of the non-combustible gases. Not so, however; for let there be but enough incombustible gas present, as there is, to displace the air, or to choke by excessive dilution the little which may remain or diffuse, then the combustible gases present, thus for the time prevented from burning, would assist in smothering the flame (being non-supporters of combustion) with as good a will, if one may use the expression, as the incombustible ones.

I would strongly recommend every tar distiller, who also works up gas liquor, to so arrange his pumping gear that he may be able to throw jets of this liquor into any part of his yard or works where fire might break out and prove disastrous. If gas liquor be not worked, then I would advise that a stock of, say, 1000 gallons be purchased. In small works this might be advantageously stored in a tank or old boiler mounted on brickwork, at such an altitude as to give pressure enough to furnish a good jet for service below when required. Of course this reservoir should be covered to prevent evaporation.

Looking at the frequent occurrence of disastrous fires in cotton mills, especially those in Lancashire, I wrote some years ago to an eminent local paper, strongly recommending that the owners of cotton mills should set tanks on the tops of their mills, and furnish these with supplies of ammoniacal gas liquor, to be always ready for service. I gave, too, a short description of the best way of arranging the pipes to these differen rooms. The gas liquor itself, by careful manipulation, may be pumped off very fairly clear, and free from tarry matter. Of course, besides to fires in cotton mills and tar distilleries, this mode of fire extinction might be all but universally applied. It may, indeed, be readily imagined how a jet of the liquor thrown into a burning room would act, the space being so enclosed, when the action is so powerful in a comparatively open space, and with such a refractory substance as burning pitch. It would seem, also, that the extinguishing power in the liquor would be even further called forth by a more intensely hot fire, for here, in all probability, the ammonia would be decomposed, and the generated nitrogen and hydrogen gases would help to swell the volume of non-supportive gas, displacing the air, and so choking out the combustion.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

As for nearly all the past week the collieries and works in this district have in most cases been closed for the Whitsuntide holidays, and as there has been no market held on the Manchester Exchange since Tuesday, there is little or nothing to report, so far as business is concerned. A moderate amount of business has been done in house coal at about late rates, and some of the contracts for gas coal have been settled within the last few days; but it is only in exceptional cases where sellers are able to command last season's rates. In other classes of fuel the market has been extremely quiet, as the holidays have temporarily stopped the requirements for ironmaking and general manufacturing purposes. The quoted prices at the pit mouth are about as under:—Best round coal for house-fire purposes, 9s. to 9s. 6d.; seconds, 6s. 6d. to 7s. 3d.; ordinary screened round coal for gas purposes, 6s. to 7s., according to quality; common round coal, 5s. 6d. to 6s.; steam coal, 4s. 6d. to 5s. 6d.; good burgy, 4s. to 4s. 3d.; good slack, 3s. to 3s. 6d.; and common sorts, 2s. to 2s. 6d. per ton.

Beyond a few small sales, there has been nothing doing in the iron trade, and prices nominally are the same as last week, although, where there has been any opportunity of testing them, the tendency has been towards greater ease. For Lancashire pig iron, delivered into the Manchester district, the quotations remain at 45s. per ton for No. 3 foundry, and 44s. 6d. for No. 4 forge, less 2½ per cent.; and for Lancashire bars, £5 10s. to £5 15s. per ton.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The shipments of coals, mostly gas, from the Tyne Dock within the last fortnight have been very large; they amount to the large total of 185,000 tons. There have been similar good shipments from other parts of the Tyne and Wear. The loading terms for gas coals are quite as long as they were a fortnight ago; they range from a fortnight to three weeks. The price of best gas coals is from 6s. 6d. to 6s. 9d. per ton, less 2½ per cent., and for second-class gas, 6s., and, in some instances, 5s. 9d., with a similar discount. The requirements for Northumberland coals are less pressing, and turns, as a rule, are shorter.

Coasting freights are dull. Steamers take up all the business that is going, and carry large cargoes, both for coasting and foreign trades, at a very moderate figure indeed.

There is a good demand for steamers to load gas coals for the Baltic ports, especially Cronstadt.

The general manufacturing trade of the North of England is not so good as it was a fortnight ago. The chemical market is quiet. The iron and lead trades are a little sickly. Coke is in good demand.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

On Saturday, the 31st ult., the Burntisland Gas-Works and distributing mains were inspected by the arbiters for the negotiating parties—the Town Council and the North British Railway Company, buyers and sellers respectively. Since then, and even almost at the last moment, it is reported that certain vacillating members of the Town Council threaten to break off the negotiations for the transfer of the Railway Company's gas-works to the town, and a strong feeling of indignation is arising at the idea of such inconsistency.

From the accounts which have now been made up in connection with the municipal affairs of Arbroath for the year ending the 31st of May, it appears that there will be sufficient funds to enable the Committee of Management of the Corporation Gas-Works to recommend a rebate of 2d. or 3d. per 1000 cubic feet on the ensuing year's price of gas. The excess of profits, after paying annuities, &c., is expected to reach £500 or £600.

The first annual general meeting of the Falkirk Lighting Company was held at their office on Thursday, the 29th ult. There was a good attendance, and the financial and other affairs were taken up and gone over in a businesslike manner. A programme was also drawn out making provision for future extensions and alterations.

A short time ago there was a good deal of complaining in Port Glasgow at the (alleged) unusually high charges made for gas in the last accounts issued to the consumers. The Manager, Mr. Carlow, had the meters tested, but still three of the complainers expressed themselves as being dissatisfied; and there has since been made an investigation of a large number of accounts with very interesting results. Acting on the instructions of one of the magistrates, Mr. Carlow prepared a statement of the different amounts paid by a given number of consumers in the different portions all over the town. A list was prepared, embracing 40 consumers in the east end of the town, 40 in the west end, and 40 at the higher levels, with the amounts paid by them respectively during the last three years. In 1877 those 120 consumers paid altogether a sum of £370 1s. 6d.; in 1878 they paid £367 5s.; and in 1879—the year that was said to have been very excessive—the total was £371 14s. 6d. The year 1879, as compared with 1877, showed an excess of 18s. 6d.; 1879, as compared with 1878, showed the excess, distributed amongst 120 consumers, of £4 9s. 6d. Bailie Hunter, while mentioning these facts, at a meeting of the Town Council held last Wednesday evening, said he was disposed to think that, while there might possibly be isolated cases of overcharging, he knew that there were cases where it had been confessed that there had been undercharging. But taking Mr. Carlow's statement as a basis—and he thought it was a very fair comparison to make—1879 certainly did not show such an excess as to afford sufficient ground for the general complaint that had been heard outside.

At a meeting of the Town Council of Dumfries, held last Thursday afternoon, the question of the analysis of gas by ex-Bailie Wood, the former Convener of the Gas Committee, was again up for consideration. After a good deal of discussion, it was resolved, by a majority of 13 to 16, to thank Mr. Wood for his past services, and express to him the wish of the Council that he should continue to test the gas.

Several transactions have taken place since last report in gas shares and annuities, and generally the recent quotations have been firmly maintained.

The Glasgow pig iron market was steady during most of the past week, and at the close there was a very good tone. A large business was done daily. Prices declined to 41s. 7½d. on Wednesday, but as high as 42s. cash and 42s. 1½d. one month was paid on Friday.

A very marked degree of dulness is shown in the Glasgow coal market, both demand and prices being at a very low ebb.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

2000.—Cougnet, J., Brussels, "Improvements in electric lamps." May 20, 1879.

2007.—Sugg, W. T., Westminster, "An improved mode of and apparatus for supplying air to gas-burners and carrying off the products of combustion." May 20, 1879.

2056.—Hancock, A., and Heath, H. S., Euston Road, London, "Improvements in meters for water and other liquids." May 23, 1879.

2060.—Blandy, A. F., Westminster, "Improvements in apparatus for electric lighting." May 23, 1879.

2073.—Foulis, W., Glasgow, "Improvements in that class of motive-power engines known as gas or hydrocarbon engines." May 24, 1879.

2091.—Wise, W. L., Westminster, "Improvements in apparatus for lighting by gas." A communication. May 26, 1879.

2100.—Cohné, S., Gracechurch Street, London, "Improvements in producing hydrocarbon gas for the purpose of increasing the illuminating power of ordinary coal gas or other gas for lighting purposes." May 27, 1879.

2109.—Abel, C. D., Southampton Buildings, London, "Improvements in wet gas-meters." A communication. May 27, 1879.

2110.—Siemens, S. W., Westminster, "Improved means and apparatus for producing light and heat by electricity." May 27, 1879.

2111.—Lake, W. R., Southampton Buildings, London, "Improvements in electric lighting apparatus." A communication. May 27, 1879.

2135.—Haddan, H. J., Westminster, "Improvements in scintillating attachments to torches, gas-burners, and tinder-boxes." A communication. (Complete specification.) May 29, 1879.

2137.—Bischof, G., Bloomsbury, London, "Improvements in the means and apparatus for effecting the purification or filtration of water, sewage, and other impure liquids." May 29, 1879.

2152.—Woolfe, H., Darlington, Durham, "Improvements in the construction of gas motor engines." (Complete specification.) May 30, 1879.

2154.—Millar, W., and Durie, J., Manchester, "Improvements in apparatus for heating or cooling liquids or gases." May 30, 1879.

2191.—Benson, M., Southampton Buildings, London, "Improvements in gas-engines." A communication. June 3, 1879.

2199.—Furstenhagen, I., Bradford, York, "Improvements in lighting by electricity." A communication. June 3, 1879.

2231.—Siemens, F., Dresden, Germany, "Improved means and apparatus for increasing the illuminating power of lamps and burners, also applicable for heating." June 5, 1879.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

4595.—Heinrichs, C. F., Queen Square, London, "Improved means and apparatus for generating electric currents, and an improved electric lamp." Nov. 13, 1878.

4645.—Sellon, J. S., Hatton Garden, Ladd, W., and Edmunds, H., Beak Street, London, "Improved means for obtaining electric light." Nov. 15, 1878.

4646.—Sellon, J. S., Hatton Garden, Ladd, W., and Edmunds, H., Beak Street, London, "Improvements in electric lamps." Nov. 15, 1878.

4662.—Sprague, J. T., Birmingham, "Improvements in producing the electric light, and in lamps applicable to that and other sources of illumination." Nov. 16, 1878.

4671.—Scott, W. L., Wolverhampton, Stafford, "Improvements in the production, regulation, and distribution of electric and electro-calcic lights." Nov. 18, 1878.

4774.—Pulvermacher, I. L., Regent Street, London, "Improvements in and connected with producing light by electricity." Nov. 23, 1878.

4852.—Aronson, J. N., Bedford Row, London, "Improvements in producing luminous effects." Nov. 28, 1878.

4893.—Wates, P. J., Greenwich, Kent, "Improvements in appliances for removing the pressure upon gas-retorts by the dip-pipes generally in use." Nov. 30, 1878.

4900.—Lake, W. R., Southampton Buildings, London, "Improvements in water-meters." A communication. Nov. 30, 1878.

4979.—Simon, R., and Beechey, C. G., Nottingham, "Improvements in and connected with gas or hydrocarbon engines." Dec. 5, 1878.

5060.—Newton, A. V., Chancery Lane, London, "Improvements in electric light regulators." A communication. Dec. 10, 1878.

5092.—Hallewell, R., Blackburn, Lancs, "Improvemements in gas motor engines." Dec. 12, 1878.

5110.—Johnson, J. H., Lincoln's Inn Fields, London, "Improvements in regulators for electric light." A communication. Dec. 13, 1878.

5113.—Crossley, F. W. and W. J., Manchester, "Improvements in gas motor engines." Dec. 13, 1878.

5169.—Haddan, H. J., Westminster, "Improvements in regulators for gas-burners." A communication. Dec. 17, 1878.

113.—Wentworth, S. W., South Hackney, London, "Improvements in portable gas apparatus for heating water or other liquids for baths and other purposes." Jan. 10, 1879.

242.—Gauster, G. P., Reading, U.S.A., "Improvements in means for lighting and extinguishing gas lights, and in apparatus connected therewith, parts of which improvements are applicable to clocks or analogous timekeepers or indicators." Jan. 21, 1879.

925.—Hedges, K. W., Westminster, "Improvements in electric lamps." March 8, 1879.

948.—Page, R. W., Hammersmith, and Sperryn, J. N., Loughborough Road, London, "Improvements in holders or galleries for supporting globes or shades for gas or other lights." March 11, 1879.

1175.—Imray, J., Southampton Buildings, London, "Improvements in electric candles." A communication. March 24, 1879.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

683.—Niebuhr, J. F. W., "Improvements in the manufacture of gas for lighting purposes, and in the means therefor." April 27, 1876.

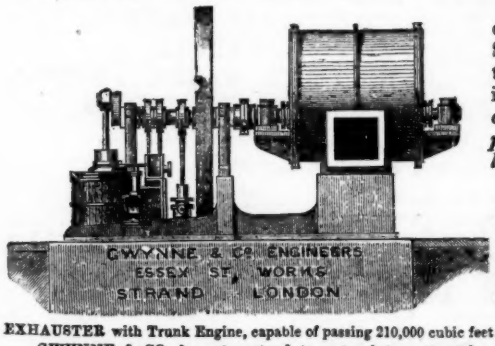
1783.—Muller, J. A., "A new or improved method for the manufacture of gas and fuel from rice husks." April 27, 1876.

1827.—Hughes, E. T., "A new or improved gas-light extinguisher." May 1, 1876.

1831.—Clark, A. M., "Improved apparatus for charging gas-retorts." May 1, 1876.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

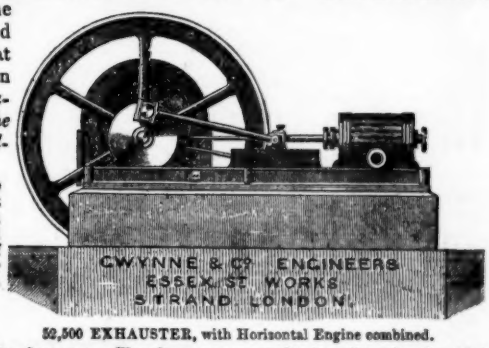
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

WANTED, Readers of the NEW Edition, 1879, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, A.I.C.E., Gas-Works, SYDENHAM, S.E.

WANTED, Masonic Votes on behalf of a Child of the late Bro. John Johnson, who was a Subscribing Member of the "Evening Star Lodge," No. 1719, and a Member of the British Association of Gas Managers.

Votes received by Bro. MAGNUS OHREN, Lower Sydenham, KENT, Secretary of the Lodge.

WANTED, by the Advertiser, a Situation as METER FIXER, Fitter, Index Taker, &c. Address Mr. GARNER, 41, Cumberland Street, Barnsbury, LONDON, N.

WANTED, by the Advertiser, a Situation as WORKS CLERK or FOREMAN of a Gas-Works. Eight years in present employment. Good references.

Address T. M., 3, Regent Street, Mile End, PORTSMOUTH.

WANTED, by a steady, energetic Man, aged 27, a Situation as GAS MANAGER. 13 years practical experience in the whole routine; 8½ years in present situation. Is a first-class Carbonizer.

The highest references and working statistics forwarded on application to "GAS MANAGER," 13, Cromwell Terrace, Cromwell Road, Colchester, ESSEX.

TO BRICKLAYERS AND RETORT SETTERS.

WANTED, to go to Christchurch, New Zealand, a thoroughly Competent Man in the above capacity. Married man preferred, and a family not objected to. Arrangements for free passage out will be made.

Apply, stating wages required, and all particulars, by letter, to J. C., 6, Westminster Chambers, LONDON, S.W., when an interview will be arranged.

None need apply whose character will not bear the strictest investigation.

TO Gas Purifier Manufacturers, &c. A London firm, having travellers waiting upon Gas Companies in home and neighbouring counties, is desirous of representing a good house.

Address E752, Address and Inquiry Office, *Times* Office.

FOR SALE.

A Combined Purifier and Condenser, with Centre Change-Valve, suitable for 300 Lights. Apply to the BRYMBO COMPANY, WREXHAM.

ELLAND-CUM-GREETLAND GAS COMPANY.

THE Directors of this Company require the services of a thoroughly competent Working FOREMAN.

The person appointed will be expected to be well accustomed to the supervision of workmen, and to possess a good knowledge of Gas-Making, Main and Service Laying, Meters, and the general routine of a Gas-Works. One who can do smith's work will have a preference.

Applications, in writing, stating wages expected, to be accompanied with copies of not more than three testimonials of recent date, to be sent in to me on or before Thursday, June 19, 1879, endorsed "Application for Foreman."

W. A. WALKER,
Secretary, &c., to the Company.

GAS-Works, Elland, June 7, 1879.

THE GASLIGHT AND COKE COMPANY.

£100,000 Ordinary "A" Consolidated Stock of the above Company, being the first portion of additional capital authorized to be raised by resolutions passed at a General Meeting of Proprietors held on Friday, Feb. 14, 1879, in pursuance of the powers of The Gaslight and Coke Company Act, 1876.

MESSRS. Edwin Fox and Bousfield, having been honoured with instructions to place the New Capital of this Company, will, in accordance with the provisions of the said Act, submit to PUBLIC COMPETITION, on Thursday, the 19th day of June, at One precisely, at the Cannon Street Hotel, City, ONE HUNDRED THOUSAND POUNDS Sterling (£100,000) ORDINARY "A" CONSOLIDATED STOCK, divided into large and small Lots to suit the convenience of all classes of Holders and Capitalists. The dividend for the year 1878 was 10½ per cent., and this is capable of very great increase. Under the said Act of 1876 an addition to the dividend (as limited prior to the passing of that Act to 10 per cent.) is sanctioned, equal to ½ per cent. for every penny reduction in price below the standard settled by such Act, viz.:—3s. 9d. per 1000 feet. The price charged has been reduced and the dividend increased; every scientific appliance is now directed to cheapening the manufacture, as well as increasing the brilliancy. The district this Company supplies includes a great portion of London proper, and Westminster, and the large suburbs to the north-west now being developed, thus necessitating increased supply, and, as consumption increases, saving of cost in production and additional profit. The existing capital of the Company consists of 1½ millions of 4 per cent. debenture capital, and 7½ millions of ordinary stock, of which three millions take a fixed proportional dividend. The net profit earned and divided in 1878, after deducting all charges, and reserving £20,256, amounted to the large sum of £711,754. The experience of many years has now clearly demonstrated the fact that gas is far the most profitable and unvarying source of income, only altering its dividends to augment them. So the results of all recent experiments to rival gas have simply tended to make its cheapness and efficiency more apparent, and to render all hope of ever surpassing it remoter still, relegating the idea of eclipsing it to the dream of the visionary or the anticipation of the adventurer.

Particulars may be obtained of Messrs. Bedford and Monier Williams, Solicitors to the Company, 1 and 2, Bucklersbury; of the Secretary to the Company, at the Chief Offices, Horseferry Road, Westminster; at the place of sale; and of Messrs. EDWIN FOX AND BOUSFIELD, 99, Gresham Street, Bank, LONDON, E.C.

EXHAUSTER FOR SALE.

FOR SALE, an Engine and Exhauster combined, to pass 7000 feet per hour, together with Boiler, 12 ft. by 4 ft., Boiler Fittings, Connections, Regulator, and Stone Bed.

For particulars, apply to W. T. TEW, Gas-Works, WARWICK.

PURIFIERS FOR SALE.

FOR SALE, price £60.—The Plates forming a Set of Two Purifiers, 12 ft. by 4 ft. 6 in. by 4 ft. deep, together with wrought-iron Covers, Lifting Tackle, Wood Sieves, Hydraulic Valve, and Connections The above are all equal to new, and very handy, requiring little floor space.

Apply to the MANAGER, Gas-Works, STONEHAVEN, N.B.

TO BE SOLD, Cheap, Three Telescopic GASHOLDERS, two 60 ft. diameter and 20 ft. deep each lift, and one 70 ft. in diameter and 20 ft. deep. Only been in use eight years. May now be seen at work at the Effingham Street Gas-Works, Sheffield.

For price, apply to THOMAS PIGGOTT AND CO., Spring Hill, BIRMINGHAM.

THE MALTA & MEDITERRANEAN GAS COMPANY, LIMITED.

NOTICE is hereby given that the ORDINARY GENERAL MEETING of the SHAREHOLDERS of this Company will be held at the Offices, 60, Gracechurch Street, London, E.C., on TUESDAY, the 24th of June, at Eleven o'clock precisely, for the purpose of receiving the Report of the Directors and the Accounts for the year ending the 31st of March, 1879; and the transaction of the general business of the Company.

One of the Directors, Major W. S. Suart, R.E., will retire from office, but is eligible for re-election.

The Transfer Books will be closed from the 18th of June until the 1st of July.

By order of the Board,
F. A. DUFFIELD, Secretary.

60, Gracechurch Street, May 27, 1879.

FOR SALE—One 12-in. Governor, and Three 12-in. internal Rack Valves, as good as new.

For particulars and price apply to Mr. FLEMING, Manager, Gas-Works, LANCASTER.

COAL TAR.

TO BE LET, from July 1st next, for One, Three, or Five years, as may be agreed upon, the whole of the COAL TAR (about 300,000 gallons per annum) produced at the Works of the Sunderland Gas Company.

Tenders, endorsed "Tender for Coal Tar," will be received until Tuesday, the 17th day of June.

Further particulars may be known on application to
JOHN H. COX, Secretary.

Sunderland, May 20, 1879.

GOVERNOR FOR SALE.

THE Shanklin Gas Company, Limited, have FOR DISPOSAL a nearly new 8-in. Air Vessel Concentric GOVERNOR, with six Ornamental Pillars, 8-in. Four-way Bye-pass Cock with Connections. Makers, Messrs. W. and B. Cowan. To be moved to make room for extensions.

Can be seen and particulars obtained on application to W. SUTHERLAND, Secretary.

THE Hampton Court Gas Company have FOR SALE, One 40 ft. by 16 ft. GASHOLDER, with six Cast Columns and Wrought Girders. To be Sold for £25, as the position is wanted.

Also the following PLANT, the whole of which is in excellent condition, having been removed for larger:—

One 8-horse Power Vertical Engine.
One 4-horse do. do.
One 15,000 feet Beale's Exhauster.
Two Beale's Slide-Valves for do.
Four Donkin's Valves.
Two Washers, with 8-in. Connections.

For further information, apply to Mr. E. PRICE, Engineer and Manager, Gas-Works, HAMPTON WICK.

GAS PLANT FOR SALE.

A 10-in. Vertical Pipe Condenser, having 20 Pipes, each 19 ft. high, on Cast-Iron Base Box.

A Scrubber, 16 ft. high 5¼ ft. diameter, fitted with thin boards, Self-Acting Liquor Distributor, 10-in. inlet and outlet pipes.

Two Single-Flue Cornish Boilers (new in 1870), each 9½ ft. long, 3 ft. 9 in. diameter; Fire Tube of Low Moor Iron, complete with all Fittings.

All in good working order; removed to make room for larger plant.

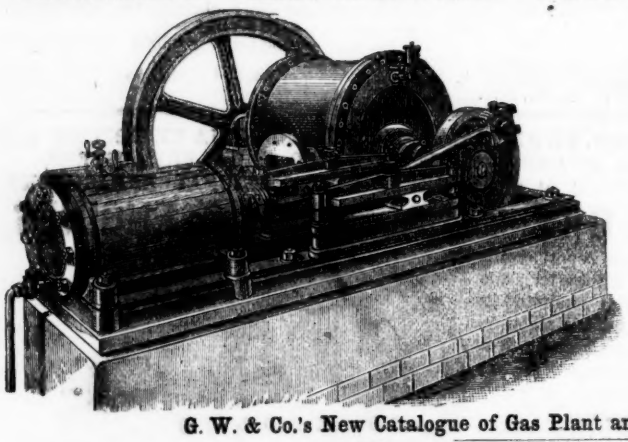
For further particulars apply to THOS. TREWHITT, Gas-Works, WEST HARTLEPOOL.

May 8, 1879.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,

WITH

Wrought-Iron Spindles and ENGINES COMBINED.



SOLE MAKERS,

GEORGE WALLER & CO.

MAKERS OF ENGINES, EXHAUSTERS, INDEX AND DISC GAS-VALVES, HYDRAULIC MAIN VALVES, BYE-PASS VALVES, TAR, LIQUOR, AND OTHER PUMPS, SCRUBBERS AND PURIFIERS, CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

Phœnix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.

TO GAS ENGINEERS.

D. BRUCE PEEBLES & CO.

Beg to call the attention of Gas Engineers to the fact that the novel and original feature in connection with PEEBLES' SYSTEM OF CONTROLLING THE ACTION OF GAS GOVERNORS is the loading or acting on the Bell by Pneumatic Pressure instead of Weights.

TAY WORKS, BONNINGTON, EDINBURGH.

THREE Purifiers for Sale Cheap, size 8 ft. by 6 ft. by 4 ft.; lids equal to new. Also Dry Centre-Valve and Connections for same, 6-inch.

Apply to J. S. CRANMER, Gas-Works, STRATFORD-UPON-AVON.

THE Sunbury-on-Thames Gas Company have FOR SALE the following PLANT in good condition, thrown out to give place to larger:—

Two Purifiers, 6 ft. by 3 ft. by 3 ft. 6 in. deep.
Two do., 5 ft. by 3 ft. by 3 ft. deep.
6-in. Connections, with two Lifting Screws and Travellers complete.
Six 6-in. Cathels's Patent Four-way Valves.
Station-Meter to pass 1500 ft. per hour, 4-in. Connections.
4-in. Governor.
5-in. Pipe Condenser.
Six 6-in. Donkin's Valves.

For further particulars apply to Mr. JOHN SMITH, Manager, Gas-Works, Sunbury-on-Thames, MIDDLESEX.

THE Oxford Gas Company have for Sale the following Second-Hand PLANT:—

A 12-horse power Horizontal Engine.
A 10-horse power Horizontal Engine.
A Cornish Boiler, 18 ft. by 5 ft.
A Cornish Boiler, 18 ft. by 4 ft. 3 in.
Steam-Valves, Tubing, and Fittings complete.
Two Purifiers, 10 ft. by 10 ft. by 4 ft., with Lifting Gear complete.
Two Condensers and Two Scrubbers, with 10-in. Valves and Connections.
A 10-in. Cockey's Centre-Valve.
Several D Mouthpieces, lengths of Hydraulic Main, Ascension, H, and Dip-Pipes, and a number of various Connections and castings, which will be sold at a little over old iron price.

For further information, apply to Mr. JAMES ELDRIDGE, Jun., Gas Works, OXFORD.

STAFFORD CORPORATION GAS DEPARTMENT.

CONTRACT FOR COAL.

THE Gas Committee are desirous of receiving TENDERS for 6000 Tons of Screened GAS COAL or NUTS, for One or Two years, commencing on the 1st of July next, to be delivered free at the Gas-Works.

Sealed tenders to be addressed to the undersigned, endorsed "Tender for Coal," specifying the description of Coal and the pit where it is to be raised, on or before the 20th of June.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
JNO. STORER, Manager.

Gas-Works, Stafford, June 5, 1879.

MACCLESFIELD CORPORATION GAS-WORKS.

COAL AND CANNEL CONTRACTS.

THE Gas Committee are prepared to receive TENDERS for the Supply of the whole or part of 4000 tons of CANNEL and 9000 tons of GAS COAL. Deliveries, free at Macclesfield, to commence as follows:—The Cannel, June, 1880, extending One year, and in such quantities as may be required. The Coal, November, 1879, extending eighteen months, in such quantities as may be required.

Tenders, specifying the description of Coal or Cannel, the pits at which they are to be raised, and the terms for net monthly payments, to be sent in not later than the 21st of June, addressed to the Chairman, Gas Committee, Town Hall, Macclesfield.

The Committee do not bind themselves to accept the lowest or any tender.

THOMAS MOORE, Engineer and Manager.

May 26, 1879.

TO COLLIERY OWNERS.

THE Corporation of the Borough of Dewsbury hereby invite TENDERS for the Supply and Delivery of the following quantities of the best GAS COAL and CANNEL:—

12,000 Tons Gas Coal.
1,000 Tons Cannel.

The Coal to be well screened and dressed, free from scales, sulphurous pyrites, or other objectionable matter. Deliveries to be made in such quantities and at such times as the Manager may direct, from July 1, 1879, to June 30, 1880. The Coal to be delivered at the Savile Town Works, or (if sent by boat) to be delivered into boxes ready for hoisting by the steam crane.

The Corporation do not bind themselves to accept the lowest or any tender.

The Contractor to state in the tender the seam and the pit from which he intends to send the Coal.

Sealed tenders, endorsed "Tender for Coal," to be sent to Jesse Smith, Esq., Town Clerk, Dewsbury, not later than Noon of Wednesday, the 25th of June.

Further particulars and forms of tender may be had on application to the undersigned.

C. ARMITAGE, Engineer and Manager.

Gas-Works, Savile Town, Dewsbury.

TO COAL PROPRIETORS.

THE Directors of the Cheltenham Gaslight and Coke Company invite TENDERS for the Supply of the best quality of COAL for Making Gas, for One or Two years, from the 1st of July next.

Quantities, particulars, and conditions of Contract may be had on application.

Sealed tenders, addressed to the Engineer, must be forwarded on or before the 18th prox.

The Directors do not bind themselves to accept the lowest or any tender.

R. O. PATERSON, Engineer.

Gas-Works, Cheltenham, May 23, 1879.

TENDERS FOR GAS COAL.

THE Directors of the Commercial Gas Company, London, are prepared to receive TENDERS for the Supply of about 86,000 Tons of Best GAS COALS, to be delivered in the Regent's Canal Basin, for the Stepney Works, and alongside the works at Wapping, in the Thames, and at Poplar, on the Bow Creek.

The quantity to be spread over the year ending June 30, 1880, and be distributed between the works in the following proportions:—

Stepney	21,000 Tons.
Wapping	34,000 ,,
Poplar	31,000 ,,

A copy of the specification with particulars of deliveries, terms of contract, and mode of payments, may be had on application.

Tenders, sealed and endorsed "Tender for Gas Coal," to be forwarded not later than the 12th of June next.

The Directors do not bind themselves to accept the lowest or any tender.

By order of the Board,
E. J. SOUTHWELL, Secretary.

Gas-Works, Ben Jonson Road, Stepney,
May 23, 1879.

SWANWICK CANNEL.

Illuminating power, 24 candles. Good Coke, 11½ cwt. to the ton.

For analysis, prices, and references, apply to

H. BOAM, Litchurch Villa, DERBY.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,
CANNEL COAL MERCHANT,
HAYMARKET, EDINBURGH.
Established 1840.

TO MAKERS OF SULPHATE OF AMMONIA AND BUYERS OR SELLERS OF GAS LIQUOR.

F. SUTTON & CO., Norwich, are now prepared to Supply a Set of Apparatus with Standard Test Solutions for the rapid and accurate analysis of Gas Liquor, which can be used by any intelligent workman, so as to show the actual amount of Sulphate which can be got out of any sample of liquor in a few minutes, without any of the annoyance arising from saturation with acid, &c. Tables are also given, showing the quantity of acid of various strengths required for any given liquor, the accurate ounce-strength and percentage of pure ammonia, &c. Price of the set, with full direction and table (copyright), with materials sufficient for fifty analyses, £4 4s.

Post orders or cheques to be made payable to F. SUTTON AND CO., Manufacturing Chemists, NORWICH, who also supply every description of Standard Solutions for Volumetric Analysis of Waters, Beers, Manures, &c., of guaranteed accuracy.

GOSPORT GAS-WORKS.

CONTRACT No. 6.
TO BUILDERS AND CONTRACTORS.

THE Directors of the Gosport Gas and Coke Company are prepared to receive TENDERS for the construction of a Retort-House, Chimney, Engine and Boiler Houses, and other Works connected therewith, at their Gas-Works, at Gosport.

Drawings and specifications may be inspected, and forms of tender and schedules of quantities may be obtained, at the Offices of the Company, at Gosport, and at the Office of Messrs. T. and C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Thursday, the 5th day of June next, and tenders must be delivered at the Offices of the Company on or before Tuesday, the 17th day of June next.

The Company do not pledge themselves to accept the lowest or other tender.

By order,
HENRY COMPTON, Secretary and Treasurer.

Gosport, May 28, 1879.

COMMERCIAL GAS COMPANY.

TO TAR CONTRACTORS.

THE Directors of the Commercial Gas Company are prepared to received TENDERS for the Surplus TAR produced at their several Works for the Twelvemonth ending June 30, 1880.

The quantities are estimated to be as under, but the same cannot be guaranteed, and may be more or less:—

At the Stepney Works, in the Regent's Canal, 380,000 gallons.

At the Wapping Works, in the Thames, 320,000 gallons.

At the Poplar Works, in Bow Creek (free waterway), 450,000 gallons.

The tenders may be for the whole or for one or more Works separately.

The Contractors must give security to remove the Tar as it accumulates, to pay for the same monthly, and generally for the due fulfilment of the contract.

The form of agreement, to be signed, can be seen at the Company's Offices.

Tenders, sealed and endorsed "Tender for Tar," to be delivered not later than the 13th of June next.

The Directors do not bind themselves to accept the highest or any tender.

By order of the Board,
E. J. SOUTHWELL, Secretary.

Gas-Works, Ben Jonson Road, Stepney, E.
May 23, 1879.

CITY OF HEREFORD.

THE Gas Management Committee of the Hereford Corporation hereby invite TENDERS for the following:—

1. For the supply and delivery of 70 Circular Retort Mouthpieces, 18 in. in diameter, with Morton's patent self-sealing lids, and Holman's patent eccentric fastenings.
2. For the Ascension, Bridge, and Dip Pipes, Hydraulics, &c., for the above number of retorts.
3. For the supply and delivery of a 20,000 cubic feet per hour Beale's Exhauster, with governor and bye-pass complete.
4. For the supply and erection of a Station-Meter, of a capacity of 20,000 cubic feet per hour, with bye-pass, &c., complete.
5. For the supply and erection of a 16-in. Station-Governor, with bye-pass complete.
6. For the supply and erection of a 16-in. Dry Centre-Valve, and 16-in. Pipe Connections, complete, to work four purifiers in course of erection.

For further particulars apply to the undersigned.

Separate tenders, sealed and endorsed, are to be addressed to the Chairman of the Gas Management Committee, and sent in on or before Tuesday, the 17th day of June next.

The said Committee do not bind themselves to accept the lowest or any of the respective tenders.

By order,
WILLIAM DAVIS, Engineer.

Gas Office, Hereford, May 27, 1879.

Price 28s., handsomely bound in Morocco, cloth sides, gilt edged and lettered.

THE FIRST VOLUME
OF
KING'S TREATISE
On the Science and Practice of the Manufacture and Distribution of
COAL GAS.

Edited by THOS. NEWBIGGING, C.E., M.Inst.C.E., and W. T. FEWTRELL, F.C.S.

Orders received by
WALTER KING, 11, Bolt Court, Fleet Street, London, E.C.

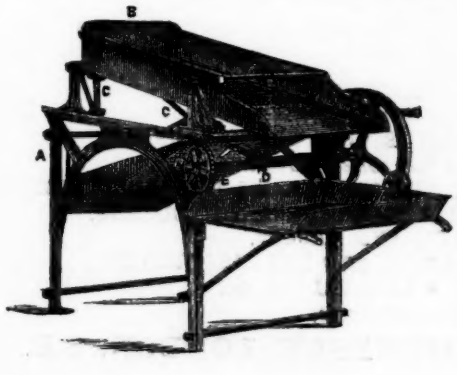
Prices, half bound, cloth sides, 2 quires, 30s.; 3 quires, 36s.; other sizes and bindings to order.

THE
GAS COMPANIES EXPENDITURE JOURNAL,

Being a Ruled Account-Book with Printed Headings, and Analyzing Guide for Keeping, upon the easiest and most correct method, the Expenditure of a Gas Company, in accordance with the provisions of the Gas-Works Clauses Act of 1871, and suitable for all Companies.

Specimen, with illustration and full particulars; 2s. 6d. returned on the purchase of a "Journal."

Published by SANDELL AND SON, Accountants, 2, Great George Street, WESTMINSTER, and W. KING, Office of the JOURNAL OF GAS LIGHTING, 11, Bolt Court, FLEET STREET, E.C.



PRICE'S PATENT
LABOUR-SAVING SCREEN OR SIFTER.

In screening breeze, the coarse material falls on a tray supported by the handles of the Machine, thus making it convenient for picking the clinkers from the same, whilst the fine falls on a shoot behind, which is fixed to the bottom of the sieve B. In screening gravel or other material, the coarse will fall into a barrow direct, and the fine be conveyed by the shoot into a barrow at the other end, or at the bottom.

To practical men the advantages of this Machine will be evident. It secures at once a saving of time, labour, and expense, as by it a much greater quantity of material can be sifted in the same space of time.

Further particulars as to price, &c., may be obtained by applying to the Patentee (Hampton Wick), or to

ROBERT DEMPSTER & SONS,
(SOLE MANUFACTURERS),
ELLAND, NEAR HALIFAX.

ECONOMY IN THE PRODUCTION OF GAS.

PLUTONIC CEMENT,

FOR JOINTING AND REPAIRING RETORTS AND OVENS *in* ACTION AND *out* OF ACTION.

A Pamphlet on the advantages of the above, with Modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,

WILLIAM RICHARDSON, Gas and Hydraulic Engineer, CHARLES HENRY STREET, and BISSELL STREET, BIRMINGHAM.

Now Ready, Price One Guinea,

PRECEDENTS IN PRIVATE BILL LEGISLATION

AFFECTING GAS AND WATER UNDERTAKINGS.

COMPILED BY MR. G. W. STEVENSON, C.E., F.G.S.

This Work contains information with regard to the practice of Parliament during the last fourteen years, in regard to most of the points on which differences arise in Opposed Bills for Gas and Water Undertakings, comprising—Authorized share and loan capital, Rates of dividend, Capitalization of profits, Term for the repayment of loans, Instances in which new shares are to be sold by auction and Exceptions to the Standing Order requiring new shares to be sold by auction, The limitation of back dividends, Illuminating power, Purity, Price, Notice before testing, The conditions under which the public supply of gas is regulated, Alteration of mains, Instances in which maps of mains are required, and All cases in which undertakings have been transferred, since 1845 in gas and 1865 in water, from Companies to Local Authorities.

In the Water Precedents will be found, in addition, The rates for a supply for domestic purposes, and the Rates for other than domestic purposes.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

THE WIGAN COAL & IRON COMPANY,

LIMITED,

DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN,

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

LIVESEY FIRE-CLAY WORKS.

NEAR BLACKBURN, LANCASHIRE.

(ESTABLISHED 1835.)

ORLANDO BROTHERS, LIMITED,

MANUFACTURERS OF PATENT CLAY RETORTS,

AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

THE FARNLEY IRON COMPANY, LIMITED,

FARNLEY, near LEEDS,

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS & FIRE-BRICKS,

Of every size and shape, and of the best quality; also of White and Coloured GLAZED BRICKS, SANITARY PIPES, &c., &c.

In order to meet the constantly increasing demand for their Gas-Retorts, the F. I. Co. have recently made such an addition to their premises as will enable them to execute expeditiously the largest home or foreign orders.

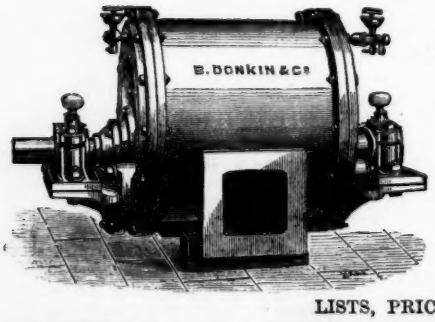
London Agent for Gas-Retorts: D. W. OGG, 3, Jeffrey's Square, St. Mary's Axe, E.C.

" " Glazed Bricks: A. BARFIELD, 22, Great George Street, Westminster.

J. BEALE'S NEW PATENT GAS EXHAUSTERS

MANUFACTURED SOLELY BY

B. DONKIN & CO.



These Exhausters have but one solid slide, which ensures less wear and friction, and thus fewer repairs are necessary. They are made with two outside bearings and with all latest improvements.

MESSRS. B. D. & CO. ALSO MAKE

STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS.
IMPROVED GAS-VALVES.
VALVES FOR AMMONIACAL LIQUOR, TAR, and HYDRAULIC MAINS,
VALVES FOR SPECIAL PURPOSES, WITH COLUMNS, SCALES, AND GAUGES.
STEAM, GAS THROTTLE, AND BYE-PASS VALVES.
SCREW WATER-VALVES, &c.

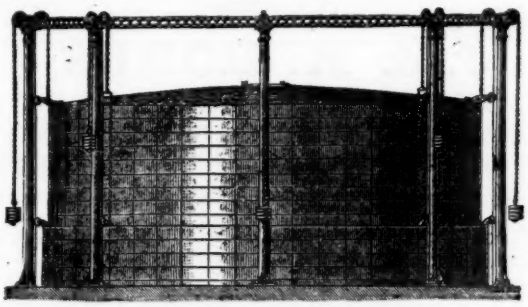
LISTS, PRICES, AND INFORMATION ON APPLICATION.

WORKS: 55a, BLUE ANCHOR ROAD, BERMONDSEY, LONDON, S.E.

WILSON CARTER AND PEARSON,
GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—**CHIEF OFFICES:**
TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.



J. T. B. PORTER & CO.,
GAS ENGINEERS & MANUFACTURERS,
IRONFOUNDERS AND CONTRACTORS,
GOWTS BRIDGE WORKS,
LINCOLN.

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.
REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash and when Cannel of the best description is scarce, it may well replace this material."

HENRY LYON (14 years Engineer and Manager of the largest of the Manchester Corporation Gas-Works) Mechanical and Consulting Gas Engineer, reports upon the condition and value of Gas-Works, supplies plans and specifications of all Apparatus appertaining to Gas-Works, and re-models existing Works.
Address Brooklyn, near Halliwell Lane, Cheetham Hill Road, MANCHESTER.

W. LIDDALL,
Public Accountant,
MOORGATE STREET CHAMBERS,
GREAT SWAN ALLEY,
MOORGATE STREET, E.C.

Mr. ROBERT DEMPSTER,
CONSULTING GAS ENGINEER,
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May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations is both extensive and reliable.

CLOTH GAS-BAGS FOR MAINS.

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber, and Gutta-Percha Machine-Bands, Sheet and Washers, and Steam Joints.

T. BUGDEN, Manufacturer,
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THE NEW GAS COOKER.
40 PER CENT. OF GAS SAVED.

No. A510 same as our **No. A152,**
BUT LINED WITH PATENT NON-CONDUCTOR.
Will Roast, Bake, and Fry, and with Three Burners for Boiling.

SIZE.
Outside—30in. high, 20in. wide, 20in. deep.
Inside—19½in. „ 14in. „ 17in. „
Price . . . . . **£4 14s. 6d.**

No. A500.
LINED WITH PATENT NON-CONDUCTOR.
Is fitted with Roasting and Baking Oven and Four Burners for Boiling.

SIZE.
Outside—34in high, 20in. wide, 19in. deep.
Inside—30in. „ 16in. „ 17in. „
Hot Plate—24in. by 23in.
Price . . . . . **£7 10s. 0d.**

No. A505.
Same as with Roasting and Baking Oven, a Broiler or Toaster, a Chop Griller, a Hot Water Boiler, and Three Burners for Boiling.
Hot Plate—26in. by 24in.
Price . . . . . **£9 15s. 0d.**

These Cookers are jacketed, on the sides, top, and door, with a new and very efficient non-conducting material, by the use of which a **saving** of gas to the extent of **40 per cent.** is effected.

Gas Companies who are selling or hiring stoves should see these stoves. Catalogues and particulars on application to

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London Warehouses: { **155a, Upper Thames Street,**
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ROBERTSONS & CO.,

TWEED IRON-WORKS,

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Makers of Socket, Flange, and Hot-Water Pipes, Tank-Plates, Lamp-Posts, Columns, Girders, and Gas and other Castings.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

Prices are Reduced.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT SUGG & KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & Co., GHENT, will receive immediate attention.

JAMES NEWTON & SONS,

(Established 1820,)

FIRE-BRICK AND TILE MERCHANTS,

Wholesale and for Exportation,

FALCON DOCK, 78 AND 79, BANKSIDE,

SOUTHWARK, LONDON, S.E.,

DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for

GAS AND WATER WORKS.

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WORKS:

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OFFICES:

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SOLE PROPRIETORS AND MANUFACTURERS OF

WOLSTON'S CELEBRATED

TORBAY IRON PAINTS.

TRADE MARK

These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Wagon Works, and the Paint Trade generally. They are the BEST PROTECTORS of WOOD, CEMENT, and IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to iron. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The undermentioned colours—ground in best linseed oil, and requiring only to be thinned down for use in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
Dart Green.	Slate.
Dart Yellow.	Buff.
Brixham Black.	Torbay Chocolate.
Light Blue.	Cream Colour.
Dart Brown.	Dart Umber.
Imperial Stone.	Light Stone.
Bronze Green.	Salmon Colour.
Navy Green.	Lead Colour.
Carriage Red.	Dark Stone.
Light Lead.	Crystal Palace Blue.
Light Green.	Iron Grey.

All other Colours made to order.

READY-MIXED PAINTS.

A great variety of Colours ready mixed for the brush are also always kept in Stock, in 3 lb., 7 lb., 14 lb., and 28 lb. cans.

Prices and Testimonials on application.

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Manufacturers of FIRE-BRICKS, LUMPS, TILES,

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N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

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BUILDERS AND CONTRACTORS

FOR THE ERECTION AND REBUILDING OF GAS AND WATER WORKS.

RETORT-SETTING—A SPÉCIALITÉ.

ROBUS'S IMPROVED RETORT-SETTINGS, guaranteed to Carbonize a large amount of Coal with a small per cent. of Fuel.

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GAS *v.* ELECTRIC LIGHT.

WIGHAM'S PATENT GAS-BURNERS

FOR

STREET LIGHTING, &c.

Speaking of these burners, erected on the Thames Embankment by Westminster Bridge, the *Daily News* says:

". . . . A blaze of light is thrown out, which, in point of efficiency and brilliancy, far surpasses the large gas-lamps lately erected in Waterloo Place, *while even the electric lights are quite thrown into the shade.*"

SOLE MANUFACTURERS:

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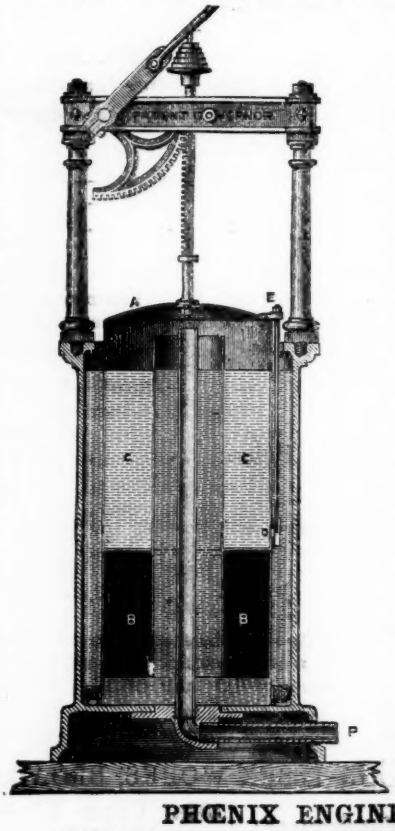
GEORGE WALLER & CO.,

GAS AND HYDRAULIC ENGINEERS,

Patent Compensating Steam Governor,

WITH SELF-CONTAINED WATER-BALANCE.



DESCRIPTION OF THE APPARATUS.

The illustration represents a section of the Patent Governor. The lower part of the Bell A is fitted with a loose Float B, and in the upper part of the Bell is a deep annular Water Chamber C, at the bottom of which is an opening D, with a slide outside regulated by a Screw Spindle E, to allow the water to pass in and out of the Chamber C quickly or slowly, according to circumstances, but when once adjusted the slide does **not require altering.** This Self-compensating Chamber gives great steadiness to the up and down movement of the Bell and effectively prevents the "hunting" motion so common with other Governors, thereby ensuring a more perfect action on the throttle-valve of the Engine **than attained by any other.** The sketch shows the clip lever fixed to work on throttle-valve at an angle, and can work in either direction. P is the Gas Inlet-pipe to Governor.

G. W. & Co. also make **special Steam Throttle Valves,** suitable for working with this Governor, and alter existing Throttle Valves to same plan.

PHŒNIX ENGINEERING WORKS,

Holland Street and Bear Gardens, Southwark, S.E.

F. & C. OSLER,

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MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

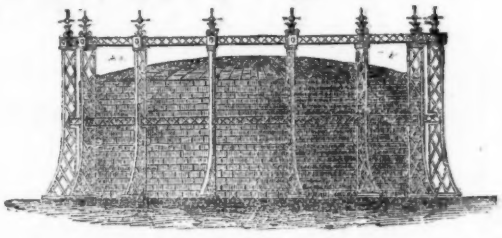
ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS.

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

6, WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

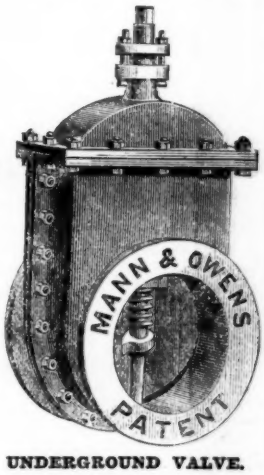
GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

MANN & OWENS' PATENT GAS-VALVE.

EVERY VALVE WARRANTED TO BE PERFECTLY SOUND AND GAS-TIGHT.



VALVE, with Indicator for Above Ground. UNDERGROUND VALVE.

The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.

The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

SOLE MANUFACTURERS:

S. OWENS AND CO.,

HYDRAULIC AND GENERAL ENGINEERS,

WHITEFRIARS STREET, LONDON, E.C.

PRICES, SIZES, AND FULL PARTICULARS ON APPLICATION.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

ALFRED LASS, F.I.Accts.,

SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,

30, GRACECHURCH STREET, LONDON.

Accounts Analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,

COTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.

Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET, DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MANWARING, 101 CARDON Street, E.C.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Keep in London and at their works large stocks of PIPES and CONNEXIONS (1½ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

CHARLES HORSLEY, Agent.

THE

SILICA FIRE-BRICK CO.,

OUGHTIBRIDGE

Near SHEFFIELD,

Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

TROTTER, HAINES, & CORBETT,

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FIRE CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.

Proprietors of

BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.

Successors to

E. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

HARPER & MOORES,

PROPRIETORS OF THE

BEST STOURBRIDGE CLAYS,

STOURBRIDGE.

Manufacturers of all Descriptions of

BEST STOURBRIDGE FIRE-BRICKS, LUMPS AND CLAY RETORTS

Of all Dimensions for Gas-Works,

GLASS-HOUSE POTS & CRUCIBLES

ESTABLISHED 1836.

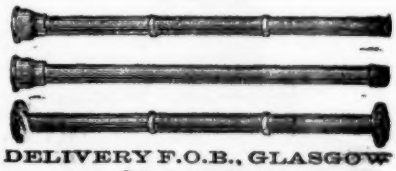
The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture. SILVER MEDAL, PARIS, 1878.

GAS AND WATER PIPES.

WILLIAM MACLEOD & CO.,

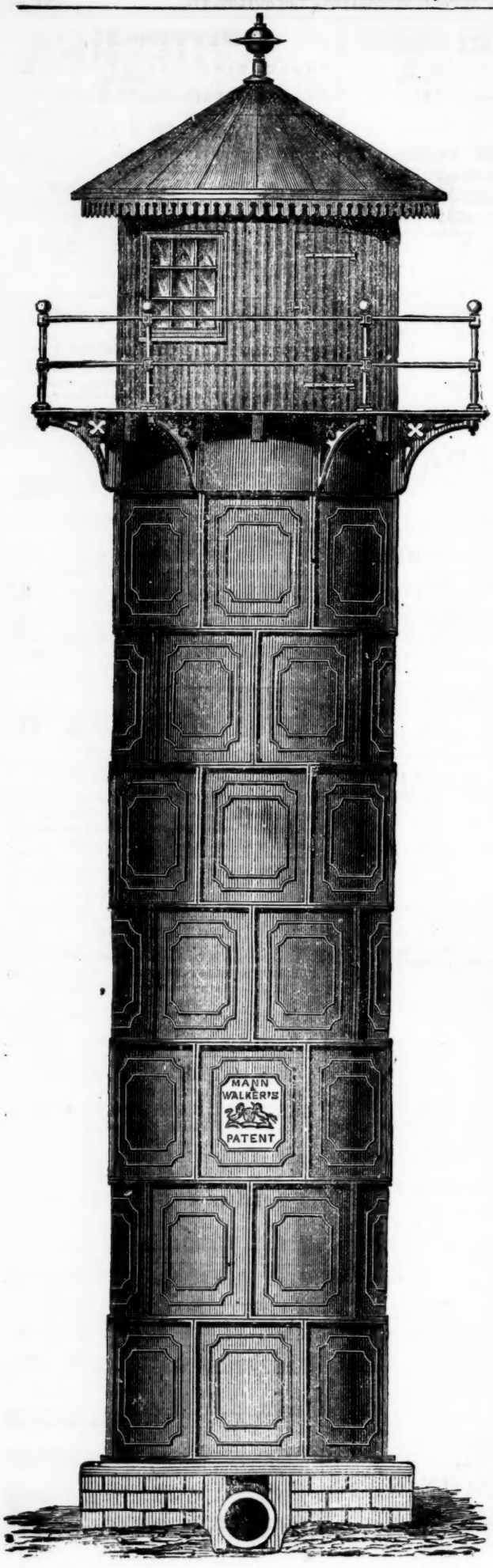
30, ST. ENOCH SQUARE, GLASGOW.

CAST-IRON GAS AND WATER PIPES.



DELIVERY F.O.B., GLASGOW

Prices on application.



C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im- portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

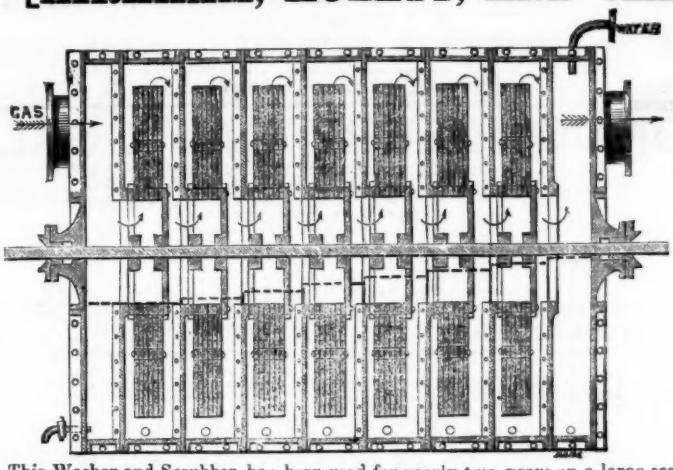
They contain their own engine power, re- quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

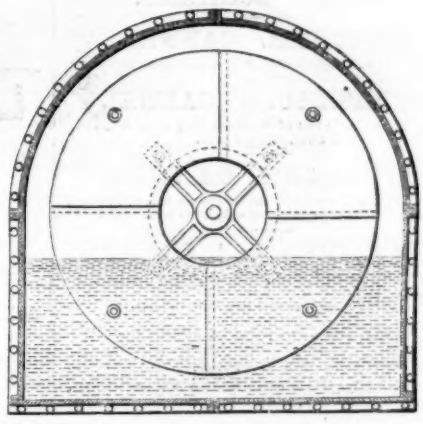
Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

THE

"STANDARD" WASHER & SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]





This Washer and Scrubber has been used for nearly two years on a large scale at the Works of The Gaslight and Coke Company, Bromley-by-Bow, at which station there are now several in operation and in course of construction. There is also one in use at the Pancras Station, King's Cross, of the same Company, which is purifying 1,500,000 cubic feet of gas per day. At the Gas-Works of the Corporation of Leeds, a large one has been erected, which is giving complete satisfaction. The Special Merits of this Washer are as follows:—

That it is a very effective Condenser, so that it is not absolutely necessary to reduce the temperature of the gas to 60°, or thereabouts, to make the Washer effective. That the distribution of the liquor is made with unerring regularity. That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather. That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided. That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas. That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured. That it is much cheaper than any other Scrubber that will do the same amount of work effectually. That it is the only Washer suitable for purifying Gas from all its impurities by solution. That it works with a minimum of pressure. That it takes out every trace of Ammonia from the Gas in once traversing the machine. That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

D. HULETT, Esq. *The Gaslight and Coke Company, Bromley-by-Bow, May 3, 1877.*

Dear Sir,—In answer to your inquiries respecting the results of the working of your Patent Washer, I beg to state that I find it a very efficient machine. I have had it in operation for some time, and passed gas through it continuously at the rate of 100,000 cubic feet per hour, and obtained from it 11 gallons of 10 oz. liquor per ton of coal carbonized—results which appear to me very satisfactory for so small a Washer. It works very smoothly, taking but little power, and giving no pressure. I have it still in operation, and am perfectly satisfied with its working.

I am, dear Sir, yours truly, (Signed) W. B. WRIGHT.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Leeds Corporation Gas-Works, York Street, Leeds, Dec. 6, 1878.*

Gentlemen,—The Scrubber-Washer erected by you at these works, and which has been in use for six months, has proved to be, so far as we have been able to test it, thoroughly efficient. We are at present making 32,000 feet of gas per hour, and are entirely dependent on this apparatus for the removal of Ammonia, and the **Gas is perfectly free from that impurity in the sixth chamber,** so that four chambers remain to deal with an increasing make of gas. Owing to insufficient condensers, the gas was in the summer admitted to the Scrubber at a temperature of 70°, but was reduced therein to 61°, or that of the atmosphere. The volutes are driven at the rate of four revolutions per minute, and, working at that speed, there is not the slightest difference between the inlet and the outlet pressure. Clean water supplied at the rate of 10 gallons per ton of coal carbonized is converted into liquor of from 10 oz. to 13 oz. strength **in once traversing the vessel.** The apparatus is extremely simple and compact, occupies but little space, and requires no foundation. I shall be surprised if it does not eventually become extremely popular.

I am, Gentlemen, yours faithfully, (Signed) HENRY WOODALL, Engineer.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Gaslight and Coke Company, York Road, King's Cross, Jan. 14, 1879.*

Gentlemen,—In reply to your inquiry, I am pleased to say, the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, **it takes out every particle of Ammonia,** while purifying more Gas than it was intended to do. I enclose particulars of a fortnight's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.—I remain, &c. (Signed) JOHN CLARK.

The following Table shows the results of the working of one of these Washers, lately erected to purify 60,000 feet of Gas per Hour, at the St. Pancras Station of The Gaslight and Coke Company:—

1879.	Nos. of the Divisions and Strength of Liquor in each.										Water used per Ton of Coals.	Gas Purified per Hour, Cubic Feet.	Ammonia on Outlet.	Temperature.			Pressures.		Revolutions per Minute.
	1	2	3	4	5	6	7	8	9	10				Inlet.	Outlet.	Atmosphere.	Inlet, Inches.	Outlet, Inches.	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.									
January 1	8½	6¾	5	3½	2½	1½	¾	¼	0	0	10 Gallons.	52,000	Nil.	77°	73°	48°	24	23	7½
,, 2	8¾	7	6	4½	3¼	2¼	1¼	½	¼	0	10 ,,	57,000	Nil.	73°	66°	32°	21½	20½	4
,, 3	9¼	8	6	3¾	3	2½	1½	¾	¼	0	10 ,,	60,000	Nil.	75°	68°	40°	23½	22	4
,, 4	9½	7¾	6¼	4¼	3¼	2¼	1¼	¾	¼	0	10 ,,	65,000	Nil.	74°	68°	33°	24	22½	5
,, 5	9½	7	6	4	3	2½	1¼	1	¼	0	10 ,,	34,000	Nil.	77°	68°	35°	14½	14	5
,, 6	9¼	7¼	6¼	4¼	3	2¼	1½	1	¼	0	10 ,,	63,000	Nil.	72°	66°	27°	24	22½	4½
,, 7	11	9	7	5½	3¾	3	1¾	1½	¾	0	10 ,,	59,000	Nil.	74°	66°	31°	25	23½	5
,, 8	9½	7½	6	4½	3	2	1	¼	¼	0	10 ,,	78,000	Nil.	73°	61°	31°	28	26½	4½
,, 9	11	9	7	5	3¾	2½	1¼	1	¼	0	10 ,,	82,000	Nil.	74°	67°	33°	27½	25½	5
,, 10	10¾	8½	6¾	5	3½	2½	1½	1	¼	0	10 ,,	66,000	Nil.	76°	64°	28°	28½	27	5
,, 11	12½	10	7¾	5¾	4¼	3¼	1¾	1¼	½	0	10 ,,	61,000	Nil.	78°	64°	27°	28½	25½	5
,, 12	11	8¾	6¾	—	—	—	1¼	¾	¼	0	10 ,,	39,000	Nil.	74°	64°	27°	26½	25½	5
,, 13	13	10¾	8¼	6	4¾	3½	2	1½	½	0	10 ,,	78,000	Nil.	73°	65°	42°	28	26	5

Messrs. KIRKHAM, HULETT, and CHANDLER. *Corporation of Birmingham, Gas Department, Saltley Works, May 23, 1879.*

Gentlemen,—I beg to enclose you a copy of the results of the tests which, by the kind permission of the Engineer, Mr. Clark, I made on the 6th of March last, of the working of one of your "Standard" Washers and Scrubbers at the St. Pancras Station of The Gaslight and Coke Company, and I am of opinion that, for an apparatus occupying so small a space, they are exceedingly satisfactory.—Yours truly, HENRY HACK, Engineer.

Working Results obtained from KIRKHAM, HULETT, *and* CHANDLER'S *Patent "Standard" Washer and Scrubber at the St. Pancras Station of The Gaslight and Coke Company, London, March 6, 1879.*

Gas passing per Hour, Cubic Feet.	—	Impurities in Gas per 100 Cubic Feet.			Temperature.		Pressure in Inches.	Revolution of Apparatus per Minute.	—	No. of Divisions and Strength of Liquor.										Water Used during Experiment. Gallons.
		SH_2	CO_2.	Grains. NH_3.	Washer.	Air.				—	—	—	—	—	—	—	—	—	—	
64,000	Inlet	2·00	2·00	158·8	72	57	21	4	Twaddel deg. at 60°	5·3	4·9	2·85	2·35	1·7	1·05	0·6	0·3	0·15	0·1	63
	Outlet	1·50	1·50	0·8	68	57	20		Acid, ounces.	11·0	8·4	6·3	4·5	2·7	1·7	1·3	0·7	0·3	—	

WASHER-SCRUBBERS OF THIS PATENT ARE IN COURSE OF CONSTRUCTION FOR BECKTON, BRADFORD, GREENWICH, WOOLWICH, AND SEVERAL OTHER GAS-WORKS.

For further particulars and testimonials, address

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

HARTHILL CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

THRASHBUSH CANNEL

12,580 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERSPOON, FERGUSSON AND CO., 21, Lime Street, LONDON, E.C.

GAS COAL.

THE MIRFIELD COAL COMPANY are supplying GAS COAL of the best quality on trucks at their siding. This Coal contains 10 per cent. of Cannel, and, as analyzed by Mr. James Paterson, of Warrington, yields 12,600 *cubic feet of* 16·67 *candle gas, with* 1430 *lbs. of good Coke, per ton.* Ash in Coke, 1·88.

Apply to the MIRFIELD COLLIERY, Mirfield, NORMANTON. London Agents: SMITH BROS., 38, THROGMORTON ST., E.C.

THE BROUGHTON COAL COMPANY,

COLLIERIES, NEAR WREXHAM,

Are prepared to Supply their excellent GAS COAL on very favourable terms.

This Coal yields more than 10,000 cubic feet per Ton of gas of good quality, *in practical working on the large scale.*

A large purchaser reports the coke to be clear, of a quality rarely equalled in the retort-furnace, and much liked by the stokers.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

W. RICHARDSON,

29, QUAYSIDE, NEWCASTLE-ON-TYNE.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

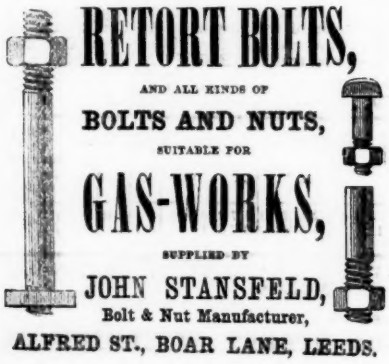
For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

M. BREMOND'S NAPHTHALINE PROCESS.

A negotiations respecting M. Brémond's patented process for preventing Deposits of

NAPHTHALINE

in Gas Main and Service Pipes should be addressed to Mr. W. H. BENNETT, 22, Great George Street, WESTMINSTER, S.W., or to M. BREMOND, Gas Engineer, Compania Madrilena de Alumbrado y Calefaccion por Gas, MADRID, who may be consulted upon all matters connected with the Gas Industry.



RETORT BOLTS,

AND ALL KINDS OF

BOLTS AND NUTS,

SUITABLE FOR

GAS-WORKS,

SUPPLIED BY

JOHN STANSFELD,

Bolt & Nut Manufacturer,

ALFRED ST., BOAR LANE, LEEDS.

FERRAND DAVIES,

148 GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,

AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL,

AND

NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.

Analyses and Quotations on application.

LONDONDERRY GAS COALS

DIRECT FROM THE

MARQUESS OF LONDONDERRY'S COLLIERIES.

COUNTY OF DURHAM.

For Prices and Particulars, apply to

MR. S. J. DITCHFIELD,

LONDONDERRY OFFICES, SEAHAM HARBOUR, COUNTY OF DURHAM.

London Agents: Messrs. LAMBERT BROS., 85, GRACECHURCH ST., E.C.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

J. & J. BRADDOCK,

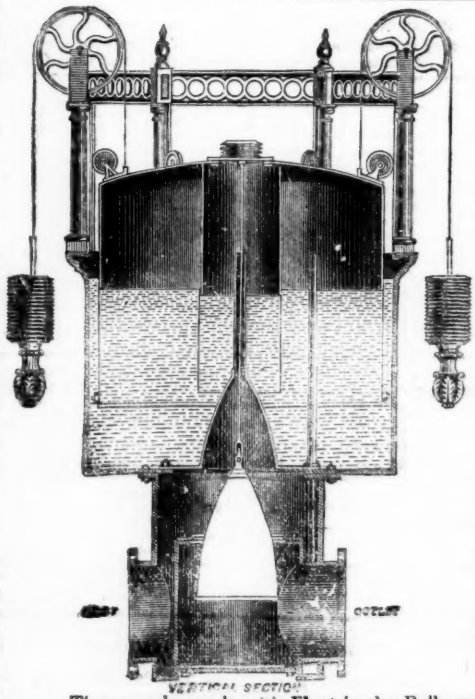
GLOBE METER-WORKS,

OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION.

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12.240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

SULPHATE AMMONIA.

R. W. WALLACE & CO.,

60, MARK LANE, LONDON, E.C.,

Are Buyers of SULPHATE AMMONIA in Large or Small Quantities, or Sell on Commission for Gas Companies and Makers.

PLANT ERECTED ON THE LATEST AND MOST APPROVED PRINCIPLE.

AGENTS to THE GASLIGHT AND COKE COMPANY, LONDON, for the SALE of SULPHATE AMMONIA. Works: BECKTON.

PARIS EXHIBITION, 1878.

THREE MEDALS
AND
HONOURABLE MENTION
HAVE BEEN AWARDED TO
JOSEPH CLIFF & SONS
For their Various Exhibits, amongst which is a
SILVER MEDAL
FOR THEIR
PATENT MACHINE-MADE
RETORTS AND FIRE-BRICKS,
Being the Highest Honour given for this class.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL
WORTLEY FIRE-BRICK WORKS,
NEAR **LEEDS,**

London Wharf: No. 4 inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,
NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"*Warrington Gaslight and Coke Company,*
Offices, Mersey Street, Warrington, April 23, 1877.

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15⅛**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.

NEW PATENT WET GAS-METER,

THE "RELIANCE,"

MANUFACTURED BY THE

GAS-METER COMPANY, LIMITED

238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

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